QUEENSLAND
DEPARTMENT
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INDUSTRIES
QV85001

LAND RESOURCES BULLETIN

MACKAY SUGAR CANE LAND SUITABILITY STUDY

PART 1. LAND RESOURCE INVENTORY

G. K. Holz and P. G. Shields

QUEENSLAND
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Queensland Government Technical Report

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Department of Primary Industries
Brisbane, 1985

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GPO Box 46
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CONTENTS

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The resources of the area are discussed in terms of climate, geology, topography, hydrology, vegetation, soils and land degradation.

During this study 53 soil profile classes and 19 variants have been identified and mapped together with six miscellaneous mapping units. Each soil profile class is described in detail.

Sixty one representative profiles from 53 soil profile classes and some of the more important soil profile class variants were sampled and analysed. Complete morphological and analytical data for these profiles are presented. Soil chemical and physical characteristics are discussed in detail.

Land degradation, in particular salinity and sodicity and soil erosion are discussed. To date the total area affected by salinity and sodicity is estimated at 400 ha and is increasing. Three broad categories were recognised - intrusion by sea water, shallow water tables and seepages associated with uplands, relict sodic areas.

Although current soil erosion is difficult to assess in cane lands it has been estimated that there are 1 740 ha suffering severe, accelerated erosion, 23 600 ha with observable though not severe symptoms of erosion and 34 100 ha of erodible lands showing little evidence of erosion but probably suffering minor rill erosion.

The complete data set for each unique map area is presented on microfiche and a soils map at a scale of 1:100 000 accompanies the report.

1. INTRODUCTION

The Mackay Sugar Cane Land Suitability Study began in 1979 in response to land use concerns affecting the sugar industry. The major concerns were the loss of both existing and potential cane land to alternative uses such as urban and industrial development and through soil erosion. Other considerations included expansion of cane growing onto marginal or unsuitable lands, the location of the lands assigned to each mill and the total cane growing potential of the district.

The steering committee for the study investigating urban expansion effects on sugar cane land around Mackay (Ullman and Nolan 1978) recommended that 'the Department of Primary Industries, in consultation with the Bureau of Sugar Experiment Stations (BSES) and other industry organisations, should examine the need for a Mackay district land capability investigation to define the extent and relative suitability for cane growing of potentially available land'.

Subsequent discussions with sugar industry groups established a need for information covering all the land assigned to and potentially available to the eight mills which comprise the Central District. Consequently, the boundaries for this study were defined to cover Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek and North Eton mill areas. Plane Creek and Proserpine mill areas will be covered by separate studies.

The study area extends from Elaroo in the north to Alligator Creek in the south and between the Clark and Connors Ranges and the coastline. Total area is approximately 290 000 ha.

The approach adopted for the study was to compile a land resource inventory and then assess the suitability of these land resources for growing sugar cane. The study results are presented in two parts. This report, Part One, documents the Land Resource Inventory. Part Two describes the land suitability for growing sugar cane.

2. THE MACKAY STUDY AREA

2.1 Location

The study area is located on Queensland's central coast (Figure 1). It includes all existing cane land for the six sugar mills: Farleigh, Racecourse, Pleystowe, Marian, Cattle Creek and North Eton, as well as likely areas for expansion of cane growing.

The coastline forms the eastern boundary from Alligator Creek in the south to Rosella Creek just north of the Stewart Peninsula. From Rosella Creek the boundary approximates the St Helens - Lacy Parish boundary west to the Clark Ranges. The western boundary follows the Clark and Connors Ranges south to Alligator Creek.

This delimits 290 000 ha of which 107 000 ha are mountainous and approximately 17 000 ha are mangroves and saltmarsh.

The distance from Alligator Creek to Elaroo in the north is 85 km and from Mackay to Netherdale in the west is 75 km.

2.2 Land use

The dominant land use is growing sugar cane. Over the ten year period 1973-82, the Mackay district (including Plane Creek mill) averaged 73.8 t cane/ha with a commercial cane sugar content (ccs) of 14.5% giving 10.7 t 94 net titre (nt) sugar/ha.

The six mills account for approximately 20% of Queensland's raw sugar production. In 1982 Farleigh mill produced 136 240 t 94 nt sugar, Racecourse 122 361 t, Pleystowe 122 637 t, Marian 109 019 t, Cattle Creek 52 271 t and North Eton 74 939 t. In June 1982 there were approximately 76 270 ha of land assigned to 1 194 farmers growing sugar cane.

The crop is predominantly rain grown but the number of farmers with irrigation is increasing. The cane crop grown in the Brightley - Eton areas has suffered from occasional severe droughts. In order to stabilise sugar production from these areas, the Eton Irrigation Scheme was commenced in 1974. The scheme is designed to harvest water from the Pioneer River at Mirani, store it in the Kinchant Dam and deliver it via open channels and pipes to approximately 200 holdings from Brightley to Sunnyside. When complete, the dam will store 62 800 Ml which is sufficient to irrigate 11 000 ha.

Beef cattle grazing is the second major rural industry. Grazing occurs on land not suited for sugar cane and on those areas which will accommodate future sugar industry expansion. Many of the beef cattle are owned by cane farmers and are run as a sideline. Breeding and fattening is the most common enterprise, followed by breeding and store production with only minor buying and fattening (Beasley 1979). Much of the best pasture land is als suitable for sugar cane so that land development for sugar is at the expense of the beef industry.

Six dairy farms operate in the study area, at Wundaru, two near Mt Charlton, near Finch Hatton, at Sunnyside and near Homebush.

There has been some interest shown in grain sorghum and soybean production, particularly in the drier parts of the district. Small areas of these crops may be planted in the future, particularly when cane prices are low.

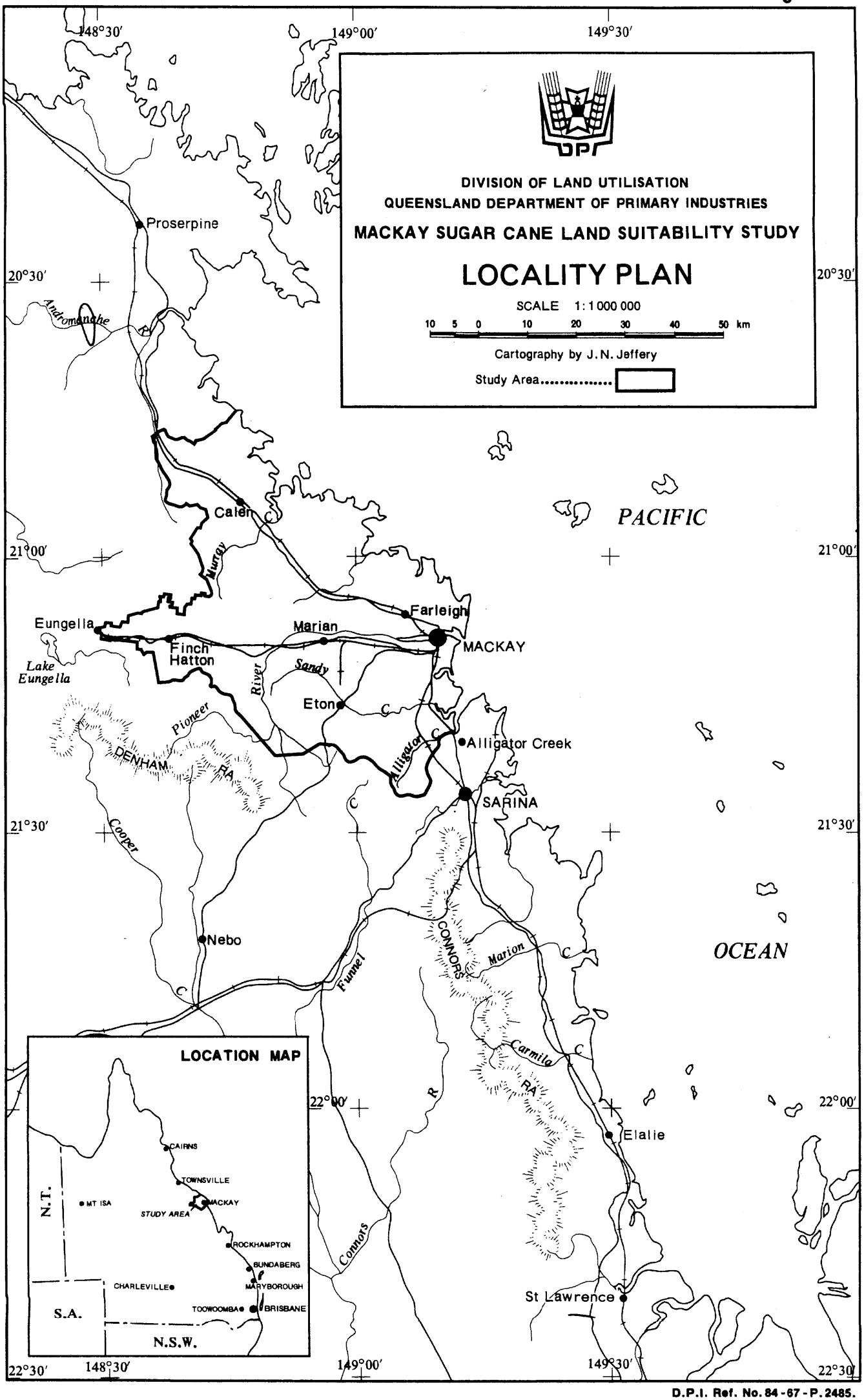
There is very little small cropping undertaken in the district. Small areas of pineapples, melons and tomatoes are grown at Bucasia, Blacks Beach and Kuttabul.

Urban and rural-urban development has become an important competitor for land. Agricultural land adjacent to Mackay has been used to accommodate urban requirements. The major growth centres include Shoal Point - Bucasia - Eimeo; Andergrove - Beaconsfield; Mt Pleasant - Glenella - Farleigh; Ooralea - Paget and Walkerston. Ullman and Nolan (1978) estimate urban and industrial land requirements to the year 2000 will be 1 192 to 1 766 ha of which 390 to 1 000 ha will be arable land.

There is an increasing demand for rural-urban and hobby farm developments. To date, developments have occurred at Eimeo, Habana, Seaforth, Yakapari, Mulei, Marian-Hampden Road, Walkerston-Peak Downs Highway and Homebush.

There is little vacant Crown land remaining in the study area. An Occupation Licence west of Seaforth was subdivided into 24 to 40 ha blocks to meet the land requirements of the last sugar industry expansion. There are several National Parks in or adjacent to the study area, of which the most popular are Cape Hillsborough on the coast and Eungella to the west of Netherdale.

Figure 1.



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3. METHODOLOGY

3.1 Resource mapping

Land resource mapping was undertaken at a scale of 1:50 000 in order to compile a resource inventory appropriate for regional planning. The inventory data are recorded in computer files.

Field work included a reference making phase followed by a mapping phase. The aim of the reference making phase was to compile tentative soil profile classes* using data recorded at 560 sites. The sites were described at different topographic positions along selected traverses through each geological formation. The site data includes soil profile descriptions to 1 200 mm as well as topographic and geological information.

The mapping phase involved describing a further 1 400 sites, checking boundaries between soils and finally, mapping onto aerial photographs (approximate scale 1:28 000). The mapping units** are compound, that is, contain several soil profile classes. Each occurrence of a mapping unit was named a unique map area or uma (after Basinski 1978). Each unique map area was given a unique number and individually described on computer files in terms of soils, topography, geology and land degradation. The smallest areas delineated were 6 to 10 ha.

The mapping units and their constituent uma's are named after the dominant soil profile classes. The dominance of the major soil and the range of associated soils may vary among the uma's of each mapping unit. This degree of complexity is indicated for each uma in the computer files by a soil variability rating.

The uma's were compiled onto eight 1:50 000 working maps. The area of each uma was measured with a digitiser and added to the data file. A soils map at a scale of 1:100 000 was subsequently produced and accompanies this report.

* A 'soil profile class' is a group or class of soil profiles, not necessarily contiguous, grouped on their similarity of morphological characteristics (Beckett 1971; Beckett and Burrough 1971; Beckett and Webster 1971; Burrough *et al.* 1971).

** A mapping unit is an area or group of areas, coherent enough to be represented to scale on a map, which can be adequately described in a simple statement in terms of its main soil profile classes (Beckett and Webster 1971).

After completing the mapping phase, soil profile classes were re-examined and described using the entire data set.

3.2 Storing and extracting data

Data is stored in a uma data file and in a site data file.

The uma data file consists of two record types, numbered 23 and 24 respectively. Record 23 contains the land resource inventory, location data, a land suitability assessment and a summary of cane assignment data. Record 24 includes the area of assigned land and the mill to which it is assigned. The codes used are described in Appendix I and the Record 23 file is given in Appendix II.

The resource data include uma number, mapping unit name (based on the dominant soil profile class), geological reference, soils variability, associated soils, landform classification, description of slopes and assessments of present erosion and secondary salting. The location data includes the grid co-ordinates of a labelling point in each uma. The land suitability assessment includes the major limitations to cane growing and the land suitability class.

All the data can be manipulated and extracted in any combination. It can be printed out in tables or in an overlay form. If needed, the resource, land suitability and cane assignment information can be extracted together.

Using the tabular form of data presentation, the required information can be sorted into groups, listed, areas summed and statistically analysed.

Using the overlay method of data presentation, a plotter plots any of the uma data at the grid co-ordinates of the uma labelling points. The plot can then be overlayed on an appropriate base map (see Figure 5, Part Two, Mackay Sugar Cane Land Suitability Study).

The site data file contains four record types. Records 1 and 2 contain location, topography and geological data of the site as well as a classification of the soil. Record 3 contains vegetation data and record 4 contains the description of the soil profile. All this data can be listed, sorted and displayed in the same manner as for the uma data. Included in the data is the name of the soil profile class which the site represents. The soil profile class name is also used in the uma data file and forms a link between the two.

The information stored on computer files can be accessed through the Director, Land Resources Branch, Department of Primary Industries, Meiers Road, Indooroopilly, Brisbane, 4068.

4. CLIMATE

4.1 Introduction

The climate of the study area has been discussed in detail by the Bureau of Meteorology (1965). Although there are several rainfall recording stations, records of other climatic variables are available only for Mackay and for the Sugar Experiment Station at Te Kowai (Bureau of Meteorology 1975).

The study area experiences generally warm, humid summers and mild, dry winters. Dick (1975) classified the area as 'Cwa', using Koppen's (1936) system of climate classification. This classification indicates rainy climates with mild winters, a dry season in the winter half-year and hot summers (mean temperature of the warmest month equals or exceeds 22^{o}C).

4.2 Climatic data

Rainfall

Monthly and annual rainfall figures for seven selected stations are shown in Figure 2. The median annual rainfall (50 percentile) varies from 1 281 mm at Eton to 1 639 mm at Te Kowai.

Approximately 70% of the median annual rainfall for all stations occurs in the four month December-March period, decreasing to a minimum between July and September.

Figure 2 shows a distinct areal variation as well as the strongly seasonal distribution. Rainfall decreases westwards from Mackay to Mirani but increases again in the Cattle Creek valley (Finch Hatton). There is also a marked decrease to the south-west around Eton and lower rainfall is experienced in the Pinevale area (BSES pers. comm.). Rainfall along the coast appears relatively uniform with only a gradual decrease north of Calen.

Some high rainfall intensities have been recorded in the study area. At Finch Hatton, a 24 hour total (9 a.m. to 9 a.m.) of 878 mm has been recorded. Falls of 63 mm in a half hour period and 150 mm in a six hour period have been estimated to recur in the study area every 10 years (Bureau of Meteorology 1965).

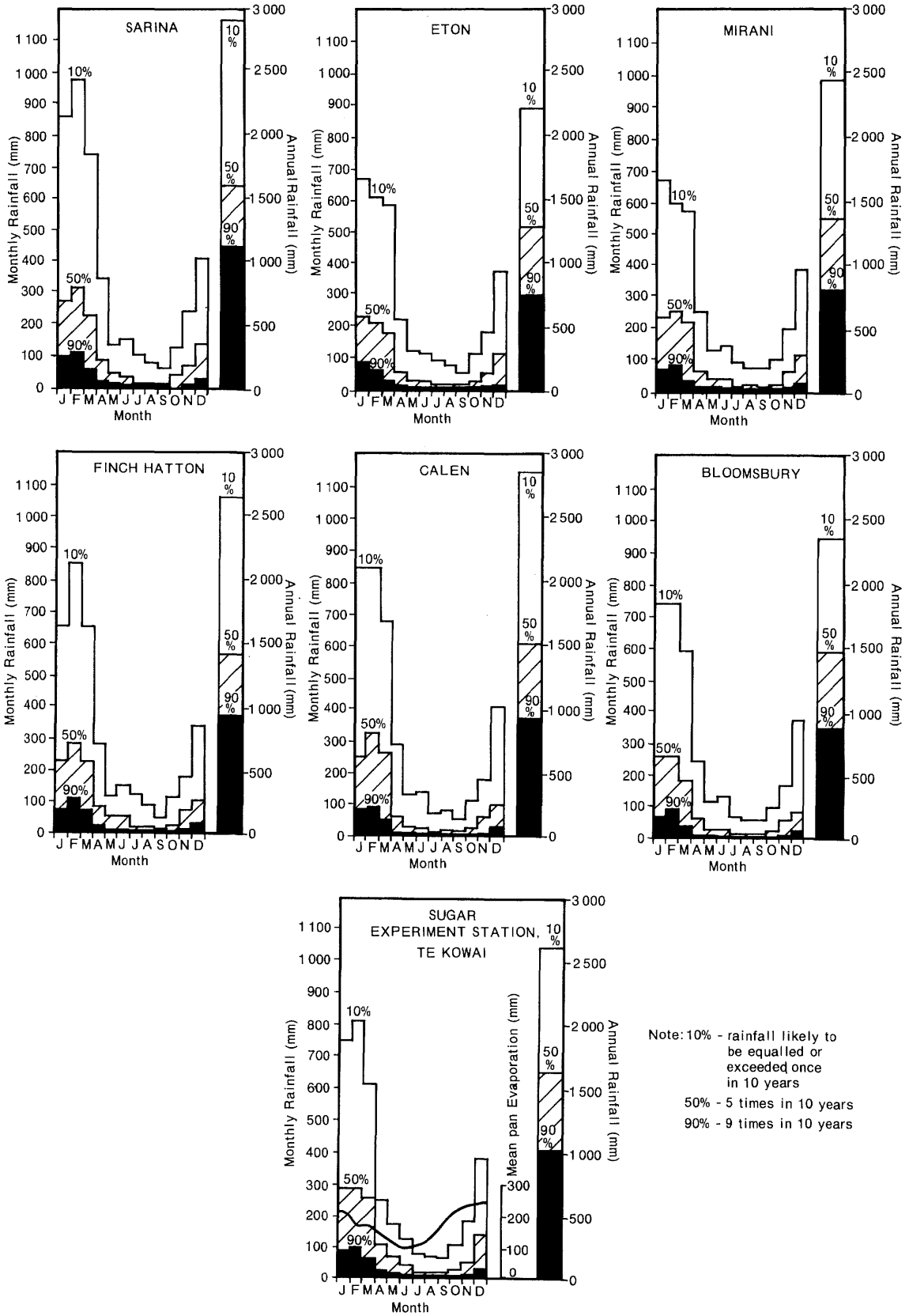

Figure 2 Monthly and Annual Rainfall for selected stations including mean monthly pan evaporation for Te Kowai

Evaporation

The mean annual pan evaporation (from August 1964 to December 1982) at Te Kowai is 2 060 mm (BSES data). Maximum rates occur during October to December declining to minimum levels in the May to July period (Figure 2). Median rainfall at Te Kowai is exceeded by mean pan evaporation in all months except January, February and March.

Temperature

Average maximum daily temperatures at Te Kowai vary from 30°C in the summer months to 23°C during winter (Figure 3). Average minimum daily temperatures vary from 21°C during summer to 10°C in winter. Temperatures of less than 5°C are experienced for an average seven days per year while an average three days per year occur with maximum temperatures of 35°C or higher.

Frost

The frost period extends from late May to early September but the main occurrence is during July and August (Story 1963). In the eleven year period 1968 to 1978, Te Kowai experienced an average of five frosts per annum (BSES data). The most susceptible areas are the alluvial flats of Gargett and Pinnacle and around Eton (Pembroke 1982). In very severe winters frosts can occur in any low-lying pockets throughout the study area except for a narrow strip adjacent to the coast (BSES pers. comm.). Such widespread frosts were experienced in 1961, 1965 and 1982 (Pembroke 1982).

Floods

The majority of the severe floods recorded have been due to tropical cyclones or rain depressions (Bureau of Meteorology 1965). However, except for the lower Pioneer River, most flooding is confined to existing stream channels.

Wind

Mackay experiences mainly south-easterly winds throughout the year (Bureau of Meteorology 1965). There is also a significant southerly component during autumn and winter which is replaced by northerly to easterly winds during spring and summer. Wind speeds between 11 and 30 km/h dominate throughout the year (Bureau of Meteorology 1979).

Cyclones

Tropical cyclones may occur during the period December to mid-April. There is a probability of one cyclone endangering the Mackay area in approximately every two cyclone seasons (Bureau of Meteorology 1965).

Hail

Hail is rarely experienced in the Mackay area but may be associated with thunderstorm activity which is at a maximum during spring and early summer (Bureau of Meteorology 1965).

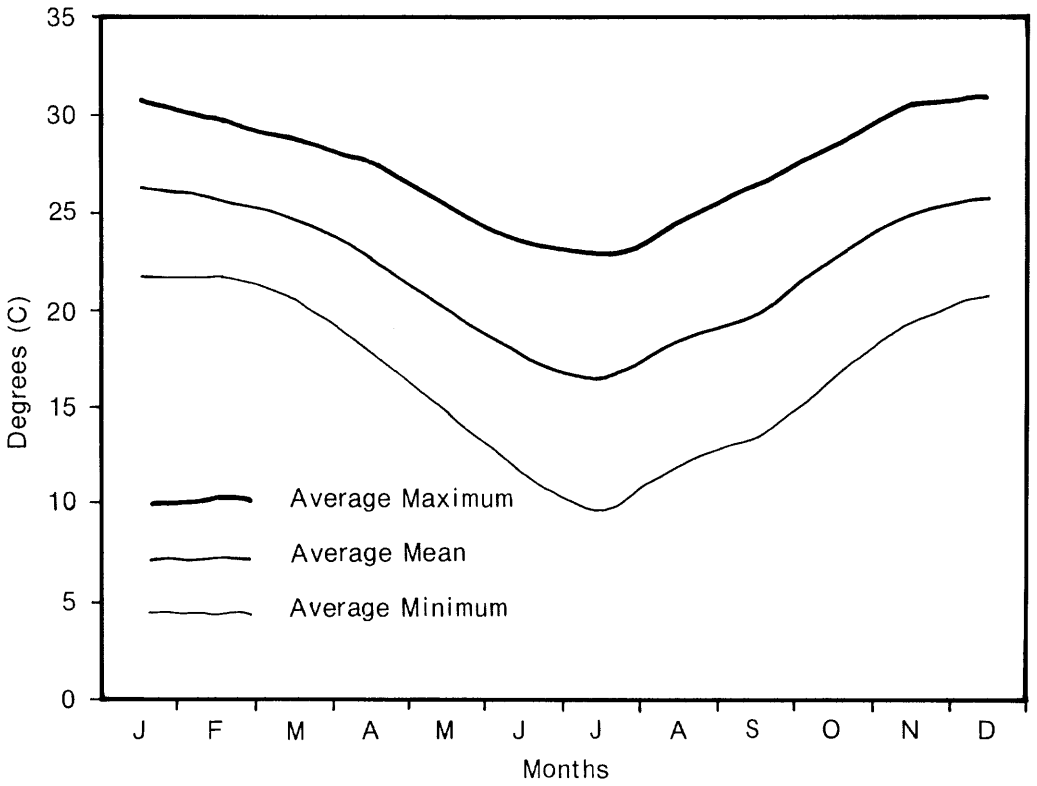

Figure 3 Temperature Data for Sugar Experiment Station, Te Kowai

TABLE 1. Relationships between soil profile class, parent material and the major geological formations.

Major Geological Formations	Soil Profile Classes for each Parent Material Type						
	Acid to intermediate volcanics and tuffs	Intermediate to basic volcanics	Acid to intermediate intrusives	Sedimentary rocks	Colluvium	Littorial sands	Alluvium
Campwyn Beds (DCc)	Mentmore (acid tuffs) Mentmore, sandy loam variant (acid tuffs) Wollingford, yellow B horizon variant (acid to intermediate tuffs and volcanics)	Belmunda (altered intermediate volcanics) Habana (range of volcanics and pyroclastics) Wagoora, basic parent material variant (basic to intermediate volcanics)			Etowrie (intermediate to basic volcanics) Etowrie, neutral duplex variant (intermediate to basic volcanics)		
Lower Bowen Volcanics/Lizzie Creek Volcanics (Plv/Plz)	Whiptail (acid volcanics) Wollingford (acid to intermediate volcanics)	Kungurri (altered intermediate volcanics) Martin (intermediate volcanics) Royston (andesite) Wagoora (intermediate volcanics)		Kuttabul (quartzose sandstone) Mulei (quartzose sandstone) Pindi (fine grained sediments)	Etowrie Ossa (probably sediments and acid to intermediate volcanics) Silent Grove (intermediate to basic volcanics)		
Carmila Beds (Pla)	Whiptail Wollingford Munbura (acid tuffs) Marwood (acid tuffs)	Nabilla (altered intermediate volcanics) Wagoora		Jumper (fine grained sediments) Palmyra (fine grained sediments) Pindi	Ossa Silent Grove		
Calen Coal Measures (Ple)		Wagoora		Kuttabul Mulei	Kuttabul, alluvial-colluvial variant (quartzose sandstone) Silent Grove		
Urannah Complex (CMr/CKr)	Wollingford, intrusive parent material variant (acid to intermediate dykes)	Pinnacle (probably basic dykes)	Dunwold (granite) Finch Hatton (granodiorite to diorite) Netherdale (granodiorite) Septimus (granite) Uruba (granodiorite) Uruba, sandy A horizon variant (granite to granodiorite)		Finch Hatton, alluvial-colluvial variant (granodiorite) Gargett (granite) Gargett, deep A horizon variant (granite) Kowari (basic dykes) Tonnalo (granite granodiorite) Uruba, alluvial-colluvial variant (granodiorite)		
Wundaru granodiorite (Kgw formerly Qs)			Farleigh (granodiorite)				
Cretaceous dykes (Kgd, Kgo, Kgp formerly Md)		Glenella (microdiorite)			Etowrie		
Quaternary alluvium (Qa)					Balberra (probably sediments and acid to intermediate volcanics) Seaforth (probably mainly acid to intermediate volcanics) Seaforth, dark B horizon variant Seaforth, yellow B horizon variant		Benholme Brightley Calen Cameron Dundula Eton Marian Marian, yellow B horizon variant Mirani Murray Narpi Pioneer Pioneer, red B horizon variant Sandiford St. Helens Sunnyside Victoria Plains Allandale Allandale, strongly sodic variant Kinchant Kinchant, coarse sandy variant
Quaternary beach ridges and dunes (Qd, Qr, Qpb, Qhb, Qhd)						Andergrove Andergrove, coarse sandy variant Andergrove, calcareous variant Neils	

5. GEOLOGY

5.1 Introduction

Some 20 geological formations have been identified in the study area by Jensen (1965), Jensen, Gregory and Forbes (1966) and Paine (1972). The original geological mapping of the Mackay and Proserpine Sheets was undertaken at a scale of 1:250 000. Where field inspections found major discrepancies from the original mapping, a geologist was consulted. Though the uma boundaries mapped at 1:50 000 could be considered as a refinement of the original maps, the uma mapping is not comparable to a geologist's map of the same scale.

Martin, Willmott and O'Flynn (in prep.) have recently completed mapping the geological formations of the Mackay 1:100 000 sheet area at a scale of 1:100 000. This updated information has been used where possible, but the codes in the data files are as for the 1:250 000 mapping.

A geological reference has been recorded for each uma except for urban areas and Kinchant dam.

Table 1 presents the relationship between soil profile classes, parent material and major geological formations.

5.2 Geological formations

The oldest formation in the study area is the Campwyn beds (DCc) of Middle Devonian to Early Carboniferous age. The formation consists of volcanic flow rocks and pyroclastics interbedded with siltstone, sandstone, conglomerate and limestone. Low-grade regional metamorphic rocks are developed locally. The volcanic rocks include agglomerate and tuffs, andesite, basalt and rhyolite. Epidotization is widespread. Campwyn beds outcrop adjacent to the coast from Mentmore through to Belmunda and just north of Mackay. They are possibly faulted against the Carmila beds on the western boundary at which point there is often a coarse conglomerate, for example, at the quarry on the Seaforth to Mt Ossa road. They are intruded by dykes of microdiorite near Mackay.

The Lower Bowen Volcanics (Plv) of Jensen *et al.* (1966) are equivalent to the Lizzie Creek Volcanics (Plz) of Paine (1972). Formed during the Late Carboniferous to Early Permian, they consist of volcanic flows and pyroclastics, with interbedded shale, greywacke, lithic and tuffaceous sandstone and conglomerate. Andesite is the most common lava type; basalt, trachyte, trachyandesite, dacite, toscanite and

rhyolite also occur. Andesitic agglomerate and andesitic to dacitic tuff are common. The volcanic rocks are extensively epidotised and chloritised.

The Lizzie Creek Volcanics are probably equivalent to the basal part of the Carmila beds (Paine 1972). These two formations are coeval but not coextensive.

Lizzie Creek Volcanics outcrop from Gargett through Mt Charlton to south of Calen. They are bounded by the Urannah Complex in the west (which also intrudes the formation near Gargett) and by Carmila beds and Calen Coal Measures in the east.

The Early Permian Carmila beds (Pla) consist of lithic sandstone, siltstone, mudstone, conglomerate, shale and acid to intermediate pyroclastics and flows. They outcrop from Sunnyside to Mia Mia in the south, at Palmyra, Glenella to Habana, and Kuttabul to Pindi Pindi in the north.

Conglomerate appears to be more common towards the base of the unit. North of the Pioneer River there are more acid to intermediate volcanics than south of the river. The volcanic rocks tend to form strike ridges, whereas the sedimentary rocks tend to occupy lower slope positions. South of the river there are proportionately more sedimentary rocks and dark grey indurated shale and mudstone are common. Rhyodacitic crystal tuff forms low rises in the Marwood and Munbura areas.

The Calen Coal Measures (Ple) are an Early Permian formation composed of quartzose sandstone, siltstone, mudstone, claystone, carbonaceous shale and coal. Intermediate sills and dykes intrude the formation.

The Calen Coal Measures overlie the Carmila beds which form the eastern boundary and the Lizzie Creek Volcanics which form the western boundary. They outcrop from Devereaux Creek in the south, through Mulei, Kuttabul and Buthurra to Calen and Elaroo in the north.

The Urannah Complex (CMr or CKr) consists of multiple intrusions ranging in age from Late Carboniferous to Early Cretaceous. It consists of granite, adamellite, granodiorite, syenite, diorite, and gabbro with abundant acid, intermediate and basic dykes. The formation outcrops along the western boundary of the study area. The Urannah complex intrudes and is faulted against the Carmila beds and Lizzie Creek Volcanics.

Early Permian or Early Cretaceous intrusives outcrop mainly as mountains west of Calen. They include altered porphyritic dolerite (PKo) (on which Wagoora soils are developed), rhyolite (PKr) and granite (PKg).

Early Cretaceous granodiorite (Kgw) has been mapped by Martin *et al.* (in prep.) as outcropping from The Leap through to Glenella. The area was previously mapped by Jensen *et al.* (1966) as Quaternary soil (Qs).

Jensen *et al.* (1966) mapped a large area of Mesozoic microdiorite (Md) from Glenella to Habana. Martin *et al.* (in prep.) have remapped much of this area as Carmila beds intruded by multiple microdiorite to dolerite dykes (Kgd, Kgo, Kgp). These dykes also intrude the granodiorite east of Farleigh.

Mt Blackwood and Mt Vince are mountainous mesozoic intrusives of granite, granophyre and dolerite (Mi). Cretaceous acid intrusives (Kg) composed of leucocratic alkali granite, granophyre and quartz syenite outcrop at Halliday Bay.

Mt Jukes consists of a central core of leucocratic granophyric quartz syenite and alkali granite surrounded by an annular valley of granodiorite (KJ_1, KJ_2). Rhyolite and dolerite dykes are common and a metamorphic aureole surrounds the complex. Recent geochronology dates the Mt Jukes complex as Tertiary (Martin pers. comm.).

The Cape Hillsborough Beds (Th) of Tertiary age consist of acid volcanics, conglomerate, shale, argillaceous sandstone, basalt and oil shale. They outcrop at Cape Hillsborough and further north near Zamia Creek.

Tertiary acid volcanic and intrusive rocks (Tr and Tv) consisting mainly of trachyte and rhyolite outcrop at The Leap and near Seaforth.

Poorly sorted, weakly consolidated sediments of Tertiary to Quaternary age outcrop at Dunrock and along Sandy and Bakers Creeks.

Tertiary to Quaternary alluvial-colluvial deposits consisting of admixed boulders, gravel, sand, silt and clay have accumulated around the base of mountains. Soils developed on alluvial-colluvial material may occur several kilometers from the source.

The Quaternary alluvium (Qa) consisting of sands, gravels, claybound gravel, sandy clays and clays have been deposited to a depth of 30 m. A wide range of soils have been developed depending on the nature of the parent material, age and topographic position. The largest areas of alluvium are associated with the Pioneer River and Sandy, Cattle, Macquarie, St Helens and Zamia Creeks.

Elevated relict plains which occur between Kinchant Dam and Mirani, and west of Mirani to Benholme have been derived mainly from alluvium from a granitic provenance. West of Mirani, rounded to subangular gravel indicates an alluvial-colluvial influence. The plains are characterised by a pan of cemented sand and some gravel at around 1.0 m below the surface. The pan is 0.5 to 2.0 m thick and is underlain by sand, clay and gravel beds. Chemical data (total potassium levels) indicates the pan may be of Tertiary age.

Jensen (1966) and Paine (1972) mapped Quaternary coastal dunes and beach ridges (Qd, Qr).

Martin (in prep.) has further recognised degraded Pleistocene beach ridges (Qpb), Holocene beach ridges (Qhb) and high dunes (Qhd) around Mackay. Particle size analysis indicates these formations are due to both wind and wave action. Coastal dunes at Mentmore have a large component of calcareous material.

Quaternary estuarine and lagoonal deposits (Qm) support mangrove and saltmarsh communities. The soils in these areas have not been described.

6. TOPOGRAPHY

6.1 Introduction

Broad landform zones in the study area have been previously described by Jensen *et al.* (1966), Bellamy (1972) and Paine (1972). There are three broad landform zones. The Clark and Connors Ranges form the western highlands. East of the western highlands lies a large coastal plain, mainly south of the Pioneer River. To the north, coastal hills separate smaller coastal plains.

Landform has been described for each uma except for urban areas and Kinchant Dam. Erosional terrain was described using the relief and modal slope categories of Speight (1984). Aggraded terrain was described using the terms given in Appendix I. Alluvial-colluvial terrain was identified by a code (c) and then described as either erosional or aggraded whichever was considered the most appropriate in each case.

6.2 Landforms

Aggraded terrain covers 98 150 ha. The areas of its components are given in Table 2.

The alluvial plains are mainly flat to very gently sloping and are incised by stream channels. They are composed of older alluvium than the terraces and levees.

The local alluvial and alluvial-colluvial flats include those mainly flat, small areas adjacent to streams; often in their upper reaches. Alluvial and alluvial-colluvial material are closely associated due to the proximity of erosional terrain.

Levees occur mainly adjacent to the Pioneer River and are difficult to differentiate from the alluvial plain in some areas.

Terraces include both the terraces and floodplains of Speight (1984). The lowest terrace or only terrace is described as TS, then the next highest TT, then TU and so on. This system is intended to indicate the complexity of terrace development in the study area. Data in Table 2 indicates that there is usually only one or two terraces developed in any location.

Stream channel has been used as the term to describe the landform of streams and some closely associated gullied lands.

Coastal dunes, beach ridges and fore-dunes have been given the same landform code because of the difficulty in separating the areas of sand formed by wind or wave action.

Marine plains include those areas inundated by tidal waters while swamps include those areas affected by seasonal or permanently high water tables of fresh water.

The areas of the slope/relief categories of erosional terrain are given in Table 3.

The relict plains (3 170 ha) are described as erosional terrain because although composed of alluvium, these areas are now elevated in the landscape and undergoing erosional processes.

Of the 22 700 ha of alluvial-colluvial terrain, 2 500 ha were described as local alluvial and alluvial-colluvial flats. The remainder was described mainly as level to gently undulating plains of erosional terrain. The alluvial-colluvial terrain often consists of long, planar, low slopes formed between sedentary erosional sloping lands upslope and aggraded terrain such as alluvial plains downslope. An example is shown in Plate 2, where erosion from flooding in Cattle Creek has truncated the alluvial-colluvial slope.

Erosional terrain covers 186 060 ha and of this 108 600 ha are mountains, hills and gullied lands with no agricultural potential.

6.3 Slopes

The general range of slopes for each landform can be inferred from the classification scheme used, especially for erosional terrain where the slope range is an integral part of the classification. The actual slope range was also recorded for all landforms having some potential for arable agriculture. The range was described in terms of the minimum, modal and maximum slopes in each uma.

The mean values recorded for these slopes are presented in Table 4. The alluvial plains are generally level but in comparison the alluvial flats have a very gentle inclination, which is due to a higher component of alluvial-colluvial terrain. The stream terraces are level but may have relatively steep slopes to other adjacent landforms. The slopes of the levees and coastal dunes (excluding the frontal dunes) are very gentle.

The slopes of the level plains of erosional terrain are similar to the alluvial plains and valley flats. The gently undulating rises have generally steeper slopes than the gently undulating plains and slopes of the undulating rises are steeper than for the undulating plains. Thus, landforms of higher relief appear to have steeper slopes than similar landforms with lower relief. There is a marked increase in the steepness of the slopes on the rolling rises and rolling plains.

Table 2. Area data for the landform components of aggraded terrain

Landform	UMA code	Area (ha)
Alluvial plain	(LA)	49 020
Marine plain (tidal flat)	(LM)	16 860
Local alluvial and alluvial-colluvial flat	(FL)	13 400
Swamp	(SP)	630
Coastal dune, beach ridges, fore-dunes	(DB)	2 300
Levee	(LE)	1 440
Stream terrace (level 1, lowest)	(TS)	5 480
Stream terrace (level 2)	(TT)	2 030
Stream terrace (level 3)	(TU)	360
Stream terrace (level 4, highest)	(TV)	110
Stream channel	(SB)	6 520
TOTAL		98 150

Table 3. Areas of land in the erosional landform categories

Erosional landform category	Area (ha)
Level to gently undulating plains	20 350
Undulating plains	11 280
Gently undulating rises	2 540
Undulating rises and low hills	43 030
Rolling rises and plains	4 040
Rolling to steep low hills, hills, steep mountains and steep rises	48 530
Very steep to precipitous low hills, hills and mountains	54 650
Badlands	1 640
TOTAL	186 060

Table 4. Mean slope values for landforms with some potential for arable agriculture

Landform	Mean minimum slope (%)	Mean modal slope (%)	Mean maximum slope (%)
Alluvial plains	0	0.2	1.3
Alluvial and alluvial-colluvial flats	0	0.4	1.7
Levees	0.1	0.9	1.8
Stream terraces	0	0.4	1.4
Coastal dunes	0.1	0.6	2.4
Level plains	0	0.4	1.6
Gently undulating plains	0.6	1.6	3.4
Undulating plains	1.4	3.2	6.7
Gently undulating rises	0.8	2.2	4.4
Undulating rises and low hills	2.0	4.7	8.6
Rolling rises and rolling plains	4.2	9.2	16.4

7. HYDROLOGY

7.1 Underground water

The Pioneer Basin which lies mainly south of the Pioneer River was proclaimed as a sub-artesian district in 1947. Major bores within the sub-artesian district which are used for irrigation, town supply or industrial purposes have to be licensed and given a pumping allocation. Selected bores throughout the basin are monitored for yield and water quality by the Queensland Water Resources Commission (QWRC). Thus considerable data are available for the underground water resource of the Pioneer Valley. Unfortunately, little data are available for underground water supplies north of the Pioneer River since the area is not proclaimed, licenses are not required and bore logs and yield information are not forwarded to the QWRC.

Underground water supplies in the north coast area are limited to generally small supplies from fractured rock with some good supplies associated with the larger areas of alluvium such as around Calen (QWRC pers. comm.).

In contrast, good supplies are available from the alluvium of the Pioneer Valley though there are generally only small supplies in the area from Sandy Creek to Alligator Creek. Bore logs indicate the Pioneer River formerly flowed from Mirani through Eton and Homebush, along Bakers Creek and that the Palms and Lagoon areas are former anabranches of the present river course (QWRC 1983). The best supplies of water are associated with these former river courses. The alluvium is up to 30 m thick but averages about 18 m. The ground water resource is considered to be fully committed over most of the area.

Good yields are associated with the fractured rock of Mt Vince.

Groundwater recharge was originally thought to be mainly from the main water courses. However, the rapid recharge of the aquifers following major rainfall events and stream water levels indicate that deep percolation of rainfall is the major source of water. The water courses act as sinks to the aquifers.

Haysom (1970) discusses water quality in the district and points out that since water quality is variable, samples should be analysed to determine their suitability for irrigation.

Water quality from alluvium in the Pioneer Basin is generally suitable for both irrigation and domestic consumption. High iron and manganese levels occur as do high boron levels in some waters adjacent to the coast. Supplies from the Carmila Beds may have excessive salt levels.

Salt water intrusion is a potential problem for users irrigating from bores adjacent to the coast. The salt water-fresh water interface ranges from 1 to 4 km from the coastline and overuse of the fresh water could lead to salt water intrusion. The QWRC is monitoring water quality from bores in susceptible areas and irrigation licenses have been limited east of the Bruce Highway between Mackay and Alligator Creek.

7.2 Surface water

Annual stream discharge is highly variable and seasonal with over 80% of annual flow in the Pioneer River occurring between December and April.

Flooding is mainly due to tropical cyclones or rain depressions (Bureau of Meteorology 1965). However, the floods are mostly confined within the stream banks with the most important exception being the lower Pioneer River. Detailed hydrological investigations have been undertaken for the Pioneer River (Ullman and Nolan 1973) and the QWRC has stream gauges monitoring flows in the Pioneer River, St Helens Creek, Cattle Creek, Blacks Creek, Bakers Creek, Sandy Creek and Alligator Creek.

The storage capacity and annual yields of existing and proposed major water storages are given in Table 5.

Table 5. Storage capacity and annual yield of existing and proposed major water storages

Water storages	Storage capacity (megalitres)	Annual yield (megalitres)
Existing		
Dumbleton Weir	1 400	6 700
Marian Weir	3 830	7 560
Kinchant Dam	62 800	51 200
Proposed		
Finch Hatton Creek	99 000	50 300
Mirani Weir (approved)	5 500	3 480 (Riparian)
Blacks Creek	493 000	162 400
Sandy Creek	8 760	8 080
Alligator Creek	30 000	8 000

8. VEGETATION

8.1 Introduction

The vegetation of the study area was described by Isbell and Murtha (1972) during broadscale regional mapping. Much of the original vegetation has been modified by extensive clearing and thinning. Large areas, used for growing sugar cane, retain no native vegetation and generally only the plant communities on hills and mountains and those fringing streams remain intact.

It is now not possible to adequately describe the original plant communities or to determine their soil relationships. Consequently, vegetation was not described or mapped in detail during the study but where possible dominant species were recorded during field inspection.

The general observations presented below are based on those recordings.

8.2 General observations

Rainforest and softwood species occurred mainly on stream terraces, in sheltered gullies and on mountains. Apart from the stream terraces and perhaps some of the fertile soils derived from intermediate to basic volcanics there is little agricultural land which formerly supported these communities.

Most of the area appears to have been eucalypt woodlands with varying dominant species, understorey and structure.

Appendix III lists the common and scientific names of the plant species discussed below.

The soils of uplands had communities composed mainly of *Eucalyptus alba*, *E. intermedia* and *E. drepanophylla* with some *E. tereticornis*, *E. tessellaris*, *Tristania suaveolens* and *E. papuana*. *Tristania suaveolens* was locally dominant on some soils, such as Jumper. *Melaleuca nervosa*, *M. viridiflora* and *Planchonia careya* were common in the understorey. The shallow, stony soils tended to support *E. drepanophylla* whereas *E. tereticornis* generally indicated fertile soils. Large *E. tereticornis* and *E. drepanophylla* were associated with highly fertile soils such as the Wagoora, basic parent material variant. *Pandanus* species occurred in some gullies and on soils with perched water tables such as Marwood. *Xanthorrhoea johnsonii* was a reliable indicator species for the Kuttabul and Mulei soils developed on quartzose sandstone. The soils derived from acid to intermediate intrusives and dykes and from acid crystalline tuffs supported layered woodlands with a wide range of species.

The soils of the alluvial-colluvial plains and the duplex soils of the alluvial plains supported woodlands composed predominantly of *E. alba, E. intermedia* and *Tristania suaveolens*. *E. tesselaris* and *E. tereticornis* were more frequent on the more fertile soils. Stands of well developed *E. alba* were associated with Narpi soils. *E. tereticornis* or *M. viridiflora* open-woodlands were associated with the clay soils, Victoria Plains and Brightley; the dominant community depending upon drainage. Large *E. tereticornis* were a feature of Dundula soils. *Tristania suaveolens* was dominant on Benholme and Balberra soils and formed locally dominant communities on other soils such as Ossa.

Kinchant and Allandale soils supported a low woodland of *M. nervosa* and *M. viridiflora* with occasional trees of *E. alba, E. tesselaris* or *E. intermedia*. The Kinchant, coarse sandy variant had a layered woodland of *E. intermedia* and *E. tesselaris* with *Melaleuca* species in the understorey. An occasional, stunted *E. alba* and *Melaleuca* species with sparse grass cover occurred on the Allandale, strongly sodic variant.

Large *Melaleuca leucadendron* and *M. dealbata* occupied Neils soils north of Habana and *M. leucadendron* open-forests occur in freshwater swamps at Slade Point.

9. SOILS

9.1 Introduction

Soils of the study area have been previously described by Isbell and Murtha (1970) as part of broadscale 1:1 000 000 mapping. van Wijk (1975) mapped and described the soils in the Eton Irrigation Area at a scale of approximately 1:125 000.

In this study 53 soil profile classes and 19 variants have been identified together with six miscellaneous mapping units.

The soil profile classes are grouped into landscape units which have similar topography and geological formation or parent material. They provide both the structure with which to present the soils information and a broadscale break-up of the study area.

9.2 Description of the soil profile classes

Each soil profile class is described in Appendix IV. Location and commonly associated soils are discussed and distribution is shown on Map 4, 'Soils'.

Information presented in Appendix IV includes:

Concept:	Intended to succinctly convey the distinguishing features of each soil profile class. The pH term (acid, neutral or alkaline) is as for the soil reaction trend defined by Northcote (1979).
PPF:	Principal profile form of Northcote (1979).
GSG:	Great soil group after Stace *et al.* (1968).
Parent Material:	Parent material and geological formation.
Landform:	As described in section 6, Topography.
Comments:	Mainly describes variability of soil profile features.

Horizon names are taken from McDonald (1977). The use of upper B_2 and lower B_2 is to indicate significant trends through the B horizon. For example, at a particular site, the acid B_{21} and B_{22} horizons may constitute the upper B_2 and the alkaline B_{23} and B_{24} horizons the lower B_2.

Most sites described were in cultivated land and so had an Ap horizon. A_1 and A_2 horizons were interpreted from uncultivated sites.

Soil colour names are those of Oyama and Takehara (1967). Colours are given for moist soil unless otherwise specified. Sporadic and conspicuous bleach are used as in Northcote (1979).

Soils of uplands derived from acid crystalline tuffs

Marwood and Munbura soils occur on gently undulating to undulating rises south of Sandy Creek. There are also two small occurrences near Seaforth but these soils have developed from granitic material and more intensive work may indicate that they belong to a separate soil profile class. The two soils are closely associated but Munbura soils tend to occupy more undulating areas than Marwood soils.

Soils of uplands derived from acid to intermediate intrusives and dykes

Sedentary soils with coarse surface textures. The Dunwold soil profile class occurs on the more acid rocks of the Urannah Complex from Finch Hatton to Septimus and around Dunwold. Septimus soil is commonly associated on upper slope and crest positions with Uruba soil developed on slightly more basic rocks. Gargett soil is common on lower, alluvial-colluvial slopes.

Septimus soil occurs sporadically between Septimus and Pinnacle and at Oakenden mainly on the more acid intrusives of the Urannah Complex where it is commonly found in upper slope and crest positions.

The Uruba, sandy A horizon variant soil occupies steep slopes in the Vales area south of Pinnacle. Associated soils include Dunwold and Septimus. Intergrades between all three soils are common.

Alluvial-colluvial soils with coarse surface textures. Gargett soil occurs on alluvial-colluvial slopes between Finch Hatton and Pinnacle, around Septimus and at Oakenden and Kungurri. Dunwold and Uruba soils are often associated on the higher sedentary slopes with Tannalo and Gargett, deep A horizon variant soils associated on similar slopes. Gargett soil merges into various soils developed on Quaternary alluvium in lower slope positions.

The Gargett deep A horizon variant soil occurs within areas of Gargett soil especially near Pinnacle and at Owen's Creek.

Tannalo soil occurs mainly between Pinnacle and Septimus and at Pinevale. Gargett and the Uruba, alluvial-colluvial variant soils are associated on the alluvial-colluvial slopes with parent material the probable determinant of each soil. Uruba and Dunwold soils often occupy sedentary positions upslope.

Sedentary soils with medium to fine surface textures. The Finch Hatton soil is located mainly on the northern side of Cattle Creek from Owen's Creek to Finch Hatton Creek. Small areas are also found near Brightley and at Mt Jukes. Netherdale and Uruba soils are associated and intergrades among the three are common.

Netherdale soil occupies steeply sloping ridges, mainly west of Pinnacle. Uruba and Finch Hatton soils are associated on lower slope positions with intergrades depending upon surface texture and degree of B horizon development.

The Pinnacle soil is located mainly at Pinnacle with another small occurrence near Netherdale. It is the only krasnozem found in the study area and occurs on hillocks surrounded by Dunwold soils.

Uruba soil occurs from Cattle Creek through to Septimus and is associated with Finch Hatton and Dunwold soils. Netherdale soil occurs on steeper slopes.

Farleigh soil is developed on granodiorite which outcrops from The Leap through to east of Farleigh. Associated soils include Victoria Plains in the drainage lines and Glenella which is formed on dykes, particularly east of Farleigh.

Alluvial-colluvial soils with medium to fine surface textures. Kowari soil occurs between Pinnacle and Netherdale on tongues of stony colluvial material from basic dykes in the Urannah Complex. Tannalo soil may be associated.

Finch Hatton, alluvial-colluvial variant soil occurs mainly north of Cattle Creek around Finch Hatton with small areas near Scrubby Mountain and at Mt Jukes. It intergrades with Uruba, alluvial-colluvial variant soil which is a common associate. Finch Hatton soil occurs on sedentary positions upslope.

The Uruba, alluvial-colluvial variant soil is located mainly in the Cattle Creek and Pinevale areas. Gargett and Finch Hatton, alluvial-colluvial variant soils are the main associates on the alluvial-colluvial slopes with Uruba soil upslope.

Soils of uplands derived from basic to intermediate volcanics

Sedentary soils. The Wagoora soil occurs throughout the study area with major occurrences from Wagoora to Calen, at Kuttabul, Silent Grove, Mia Mia and Walkerston. Skeletal soils are associated on steep slopes or near rock outcrop. Silent Grove soil occurs downslope on alluvial-colluvial materials. Where the volcanic rocks intrude sedimentary rocks Pindi and Jumper soils are associated. Wollingford soil is a common associate on intermediate to acid volcanic rocks.

The Wagoora, basic parent material variant soil occurs west of Seaforth, along the St Helens beach road and at Mentmore. The parent material appears to be more basic than that of Wagoora and though the two soils are morphologically similar the chemical analyses from the representative profiles indicate they are quite different. Associated soils include Mentmore, Belmunda and Skeletal.

Nabilla soil occurs mainly on undulating rises around Mt Vince and north of Mia Mia. Wollingford soil is associated on intermediate to acid volcanics and Skeletal soils are associated on crests and near rock outcrop.

Royston soil occupies mid to upper slope positions on undulating rises at Royston Park and Dows Creek. It merges into Silent Grove soil down the slope. Skeletal soils are often associated on crests. Surface cracking was not observed in the Royston soil under pasture but cracking may develop with cultivation (McDonald pers. comm.).

Martin soil is found between Mt Martin and Kungurri. Skeletal and Kungurri soils are associated along ridge crests with Etowrie soils developed downslope on alluvial-colluvial materials.

Kungurri soil occurs on ridge crests between Mt Martin and Kungurri where it is associated mainly with Martin soil.

Glenella soil occurs mainly between Glenella and Habana on microdiorite dyke rocks. The dyke rocks intrude granodiorite on which Farleigh soil is developed. Habana soil is closely associated and intergrades with Glenella are common due to parent material variability. Etowrie soil is often developed downslope on alluvial-colluvial materials with Victoria Plains soil common in the drainage lines.

Habana soil occupies steep slopes between Glenella and Habana. The parent material appears to be highly variable including acid to intermediate volcanics and tuffs. Skeletal and Mentmore soils are common associates and intergrades with Glenella often occur.

Alluvial-colluvial soils. Silent Grove soil is found throughout the study area with major occurrences at Yalbaroo, Silent Grove, Royston Park and Brightley. It is usually found downslope from sedentary soils derived from basic to intermediate volcanics and often merges into Victoria Plains soils further down the slope.

Etowrie soil occurs from Habana to Glenella, at Mt Martin and at Devereaux Creek. Habana, Glenella and Martin soils are commonly associated on the sedentary upper slopes. Etowrie soil merges into duplex soils and uniform clays of the alluvial plains.

The Etowrie, neutral duplex variant soil occurs at Mentmore on alluvial-colluvial material from intermediate volcanics. Mentmore soil is associated in the upper slope positions with Calen soil occurring further down the slope.

Soils of uplands derived from acid to intermediate volcanics

Whiptail soil occurs on acid volcanic rocks throughout the study area but mainly north of Calen. It occupies upper slope positions and has Skeletal and Wollingford soils closely associated.

Wollingford soil also occurs throughout the study area developed on acid to intermediate volcanics. Whiptail and Skeletal soils are most commonly associated.

The Wollingford, intrusive parent material variant soil is located mainly in the low rainfall Pinevale area. The Uruba, alluvial-colluvial variant soil is closely associated. There is also one small occurrence west of Finch Hatton where the soil is developed on dyke rocks.

The Wollingford, yellow B horizon variant soil occurs on Campwyn Beds near St Helens beach, west of Seaforth and at Habana. Associated soils include Mentmore, Belmunda and Skeletal.

Mentmore soil occurs at Mentmore, west of Seaforth and at Habana. It has shallow profiles and is closely associated with Skeletal soils. Belmunda and Wollingford, yellow B horizon variant soils are other common associates.

The Mentmore, sandy loam variant soil is located west of Seaforth and at Mentmore. Mentmore and Belmunda soils are the major associates.

Belmunda soil occurs in the St Helens, Seaforth and Belmunda areas. Mentmore and Skeletal soils are the common associates. Intergrades with Wagoora, basic parent material variant may occur.

Soils of uplands derived from sedimentary rocks

Pindi and Jumper soils occur from Yalbaroo to Calen, south of Walkerston, from Brightley to Eton and at Kungurri. The two soils are closely associated, differing mainly in B horizon colour and pH. Development of these properties appears to be related to particular beds within the sedimentary sequence. Rock bars with associated Skeletal soils are common through both soils.

Palmyra soil is located on Carmila Beds between Walkerston and Homebush. Its development is probably due to a greater proportion of the more weathering resistant indurated mudstone in the sedimentary rocks of this area. Associated soils include Pindi, Jumper and Skeletal.

Kuttabul and Mulei soils occur on quartzose sandstone between Kuttabul and Yakapari, at Elaroo, Devereaux Creek and at Kungurri. The two soils are closely associated though Kuttabul soil is the more extensive. Skeletal soils are common on crests. The presence of *Xanthorrhoea* sp. is a useful indicator for both these soils.

Soils of the alluvial-colluvial plains derived from sedimentary rocks and acid to intermediate volcanics

The Ossa soil occurs mainly in the Narpi and Oakenden areas but is found throughout the study area on alluvial-colluvial slopes from Carmila Beds and Lizzie Creek Volcanics. A range of upland soils derived from sedimentary rocks and acid to intermediate volcanics occur upslope. Downslope Ossa soil merges into various duplex soils of the alluvial plains.

The Ossa, cobbly variant soil occurs at the footslope of hills from Oakenden to Sunnyside and is a close associate of Ossa in these areas.

Seaforth soil occurs between Seaforth and Belmunda on alluvial-colluvial slopes from Campwyn Beds. It is morphologically similar to Ossa soil. Mentmore and Belmunda soils occupy sedentary upslope positions and it is often adjacent to the Mangroves and Saltmarsh unit.

The Seaforth, dark B horizon variant soil occurs around Seaforth on alluvial-colluvial slopes. Seaforth soil is associated while downslope it merges into Victoria Plains and Calen soils.

The Seaforth, yellow B horizon variant soil occurs near St Helens beach and Mentmore. Associated soils include Calen and Mentmore.

Balberra soil is located in only one large area between Munbura and Balberra. It surrounds low rises of acid crystalline tuffs but appears to be part of an alluvial-colluvial continuum from other rocks within the Carmila Beds. It merges into Ossa soil upslope and Sunnyside soil downslope.

The Kuttabul, alluvial-colluvial variant soil is located at Devereaux Creek and Kuttabul. It has developed on alluvial-colluvial slopes from quartzose sandstone. Kuttabul and Skeletal soils occupy sedentary positions upslope. Mulei soil may occur in similar alluvial-colluvial positions. In areas of restricted drainage alkaline profiles with affinities to Jumper soil have developed.

Soils derived from Quaternary alluvium

Duplex soils of the alluvial plains. The Calen soil occurs on alluvium throughout the study area. Major occurrences are around Calen and Mt Pelion and south of the Pioneer River. Victoria Plains and Brightley soils are associated in slightly lower areas with poorer drainage. Sandiford and Calen soils are closely associated south of the Pioneer River where Marian and Mirani soils occur on slightly elevated areas. Calen is an ubiquitous soil and is associated with most other soils derived from Quaternary alluvium.

Narpi soil is located in the Narpi area on the alluvium of Macquarie Jolimont and Palm Tree Creeks. Victoria Plains, Brightley and Calen soils are associated. Ossa soil may occur upslope. An extensive system of stabilised gullies has developed within these soils.

Eton soil occurs mainly in the Brightley and Eton areas where associated soils include Victoria Plains and Brightley.

Sunnyside soil is most extensive in the Sunnyside area but there are other occurrences near Homebush and Dunrock. It often merges with Ossa or Balberra soils. Brightley and Calen soils are common associates on the alluvium.

Sandiford soil occurs on the alluvial plains south of the Pioneer River and east of Walkerston. It is closely associated with Calen soil and more intensive study will be required in order to ascertain their topographic and parent material relationship. Marian and Mirani soils are associated on slightly elevated areas.

Marian soil occurs extensively along the Pioneer River and Cattle Creek. It occupies back slopes of levees where it is associated with Pioneer soil and slightly elevated areas on the alluvial plain where it is associated with Calen soil. Its profile morphology ranges between those of Calen and Pioneer soils.

The Marian, yellow B horizon variant soil occurs along Sandy Creek from Allandale to Homebush. It occupies similar landform positions to Marian soil and is associated with the Pioneer, red B horizon variant (in slightly elevated areas) and Brightley, Calen and Eton soils which occur in lower positions.

Mirani soil is extensive between Mirani and the coast south of the Pioneer River. It occupies slightly elevated, usually elongated rises on the alluvial plains. Calen and Sandiford soils are associated in lower positions.

Uniform clays of the alluvial plains. The Victoria Plains soil is ubiquitous, occurring in depression areas with poor external drainage. Brightley and Calen soils are commonly associated and many other soils may be associated in better drained positions.

Brightley soil is closely associated with Victoria Plains soil but does not have the same degree of self-mulching or seasonal cracking as Victoria Plains soil. The most common duplex soil associates are Calen, Eton and Marian.

Benholme soil occurs extensively west of Mirani through to Dunwold. It is often situated below the Kinchant, coarse sandy variant soil which occupies elevated, gently undulating plains. Calen soil is associated on the alluvial plain.

Dundula soil is situated adjacent to the coast between Mackay and Alligator Creek and at Habana and Belmunda. Mangroves and Saltmarsh commonly form the coastal boundary. Andergrove and Andergrove coarse sandy variant soils are often associated on adjacent coastal dunes. Small areas with high salt levels occur within the Dundula soil.

Duplex soils of the relict plains. The Kinchant and Allandale soils occur on elevated plains between Allandale and Mirani. They are closely associated with each other with the Kinchant soil usually occupying upper slope positions. Intergrades between the two soils are common. The extent of the cemented pan which commonly underlies these soils at around 1 m is unknown but may be discontinuous.

The Allandale, strongly sodic variant soil is an associate of Kinchant and Allandale soils between Allandale and Kinchant Dam.

The Kinchant, coarse sandy variant soil occurs on elevated gently undulating plains from Mirani to Benholme. It occurs on similar landform, overlies a similar pan and is morphologically similar to Kinchant soil. However, it supports different vegetation communities and has a non-sodic B horizon. The underlying pan contains more angular, coarse fragments than further east and the Kinchant, coarse sandy variant soil is probably closer to the source material of the relict plains.

Soils of the levees, terraces and floodplains. The Pioneer soil occurs extensively along levees of the Pioneer River. Marian soil is associated on the levees and Cameron soil occurs on lower nearby terraces.

The Pioneer, red B horizon variant soil is located along levees and terraces of Sandy Creek. Morphological properties are similar to Pioneer soil except for slightly stronger profile development. This evidence combined with the fact that these two soils occur along Sandy Creek and the Pioneer River may support the view that Sandy Creek is a former course of the Pioneer River. The Marian, yellow B horizon variant soil is closely associated with the Pioneer, red B horizon variant soil.

St Helens soil occurs on higher terraces of the major streams such as St Helens, Cattle Creek, Owens Creek and the Pioneer River. Cameron soil usually occurs on lower terraces though often the different levels merge and intergrades between the two soils are common.

Cameron soil occurs on terraces and floodplains of the major streams, often between Murray soil on lower level floodplains and St Helens soil on the higher terraces.

Murray soil occurs on low level floodplains of streams, commonly only slightly higher than the streambed. Cameron soil is commonly associated.

Soils of the beach ridges and coastal dunes

The Andergrove soil occurs on beach ridges and dunes adjacent to the coast often immediately behind either Mangroves and Saltmarsh or Frontal Dunes mapping units. The largest occurrence is around Andergrove where the former dunes and beach ridges are up to 4 km inland. In this location small areas of undescribed red earthy sands and red earths occur on some ridge crests. Freshwater Swamps mapping units occupy depressions between dunes in some areas.

The Andergrove, coarse sandy variant soil occurs adjacent to the coast behind either Mangrove and Saltmarsh or Frontal Dunes mapping units. It occurs south of Mackay often with Dundula soil on adjacent alluvial plains. Freshwater Swamps mapping unit may occupy depressions between dunes.

The Andergrove, calcareous variant soil occurs only at Mentmore where the beach deposits have a high proportion of calcareous material. Undescribed sands of the Frontal Dunes mapping unit are associated.

Neils soil occurs adjacent to the coast north of Etowrie and at Bucasia. Mangroves and Saltmarsh mapping units form the coastal boundary.

The Frontal Dunes mapping unit includes undescribed siliceous sands of the high fore dunes.

Miscellaneous units

The Mountains and Hills mapping unit include all uplands unsuitable for cultivation. They are described in the data file in terms of geological formation and landform.

The Gullied Lands mapping unit includes all gullies whether in uplands or lowlands. Most of the gullied lands mapped are stabilised areas which are unsuitable for cultivation due to the extremely broken topography.

The Streambeds mapping unit includes the streambeds and banks of water-courses through the study area.

The Mangroves and Saltmarsh mapping unit includes those areas inundated by sea water. The soils have not been described.

The Freshwater Swamps mapping unit includes permanent freshwater swamps and the soils have not been described.

The Urban and Industrial mapping units have not been described in terms of their land resources since they are considered permanently alienated from agricultural use.

Sketelal soils include shallow, gravelly, stony, cobbly soil and lithosols. No area has been given for Skeletal soils for although they are commonly associated with many sedentary soils, any uma's in which they are dominant have been mapped as Mountains and Hills.

9.3 Notes on the mapping units

The soils are mapped as compound mapping units (containing several soil profile classes).

A mapping unit is an area or group of areas coherent enought to be represented to scale on a map, which can be adequately described in terms of its main soil profile classes (Beckett and Webster 1971). It is named after the dominant soil profile class present. Uma's in which there are two co-dominant soils are indicated in the data files by a soil variability rating but these mapping units have not been indicated on the soils map due to the limitation of map scale on data presentation.

The total area of each mapping unit is given in Table 6. The area given for a mapping unit only approximates the area of its dominant soil profile class since it also includes the area of the associated soils.

9.4 Chemical and physical characteristics of soils

Sixty one representative profiles from 53 soil profile classes and some of the more important soil profile class variants were sampled and analysed. The morphological and analytical data for representative soil profiles are listed in Appendix V.

The analytical methods used and general intepretations of soil test results are as outlined in Bruce and Rayment (1982).

All profiles were sampled with a jarret auger in 100 mm increments to 1 200 mm or shallower if parent material was encountered. If an horizon boundary was found the 100 mm sample was divided accordingly.

Table 7 lists the sites, condition of site, and soil profile classes sampled. Of the 61 profiles sampled, 23 were in cultivated land, 23 cleared and 15 from uncleared land.

Table 6. Areas for each mapping unit

Mapping unit name	Area (ha)
Soils of uplands derived from acid crystalline tuffs:	
Marwood	310
Munbura	910
Soils of uplands derived from acid to intermediate intrusives and dykes:	
sedentary soils with coarse surface textures	
Dunwold	3 650
Septimus	40
Uruba, sandy A horizon variant	80
alluvial-colluvial soils with coarse surface textures	
Gargett	3 640
Gargett, deep A horizon variant	420
Tannalo	1 210
sedentary soils with medium to fine surface textures	
Finch Hatton	1 650
Netherdale	800
Pinnacle	120
Uruba	2 140
Farleigh	2 590
alluvial-colluvial soils with medium to fine surface textures	
Kowari	290
Finch Hatton, alluvial-colluvial variant	430
Uruba, alluvial-colluvial variant	550
Soils of uplands derived from basic to intermediate volcanics:	
sedentary soils	
Wagoora	3 000
Wagoora, basic parent material variant	840
Nabilla	2 230
Royston	710
Martin	820
Kungurri	40
Glenella	2 210
Habana	1 450
alluvial-colluvial soils	
Silent Grove	2 770
Etowrie	1 520
Etowrie, neutral duplex variant	230
Soils of uplands derived from acid to intermediate volcanics:	
Whiptail	4 360
Wollingford	6 230
Wollingford, intrusive parent material variant	160
Wollingford, yellow B horizon variant	1 110
Mentmore	3 770
Mentmore, sandy loam variant	300
Belmunda	1 150
Soils of uplands derived from sedimentary rocks:	
Pindi	5 460
Jumper	1 540
Palmyra	690
Kuttabul	5 520
Mulei	280

Table 6. Continued

Mapping unit name	Area (ha)
Soils of alluvial-colluvial plains derived from sedimentary rocks and acid to intermediate volcanics:	
Ossa	5 850
Ossa, cobbly variant	440
Seaforth	1 090
Seaforth, dark B horizon variant	180
Seaforth, yellow B horizon variant	160
Balberra	1 520
Kuttabul, alluvial-colluvial variant	2 420
Soils derived from Quaternary alluvium:	
duplex soils of the alluvial plains	
Calen	12 630
Narpi	3 230
Eton	1 360
Sunnyside	4 250
Sandiford	5 900
Marian	6 480
Marian, yellow B horizon variant	1 340
Mirani	3 780
uniform clays of the alluvial plains	
Victoria Plains	10 020
Brightley	8 000
Benholme	1 070
Dundula	1 450
duplex soils of the relict plains	
Kinchant	1 570
Kinchant, coarse sandy variant	1 230
Allandale	230
Allandale, strongly sodic variant	140
soils of the levees, terraces and floodplains	
Pioneer	2 470
Pioneer, red B horizon variant	600
St Helens	2 380
Cameron	2 970
Murray	1 350
Soils of the beach ridges and coastal dunes:	
Andergrove	1 190
Andergrove, coarse sandy variant	290
Andergrove, calcareous variant	100
Neils	280
Frontal Dunes	440
Miscellaneous units:	
Mountains and hills	106 960
Gullied lands	4 270
Mangroves and saltmarsh	16 810
Freshwater swamps	630
Streambeds	3 890
Urban and industrial	4 510

Table 7. Site number, condition of site, and soil profile class sampled

Site No.	Soil Profile class	Site No.	Soil Profile Class
S 1	Whiptail (UC)	S 32	Kinchant, coarse sandy variant (C)
2	Calen (C)		
3	Jumper (UC)	33	Allandale, strongly sodic variant (UC)
4	Silent Grove (C)		
5	Jumper (UC)	34	Kinchant (UC)
6	Wagoora, basic parent material variant (C)	35	Allandale (UC)
		36	Tannalo (C)
7	Wagoora (C)	37	Gargett (C)
8	Calen (C)	38	Pinnacle (V)
9	Victoria Plains (C)	39	Netherdale (UC)
10	Narpi (C)	40	Uruba (C)
11	St Helens (V)	41	Kowari (C)
12	Pindi (UC)	42	Finch Hatton (V)
13	Cameron (V)	43	Pioneer (V)
14	Seaforth (C)	44	Marwood (UC)
15	Belmunda (C)	45	Munbura (C)
16	Wagoora basic parent material variant (UC)	46	Dundula (C)
		47	Balberra (UC)
17	Ossa (UC)	48	Sunnyside (C)
18	Mulei (UC)	49	Septimus (V)
19	Kuttabul (UC)	50	Nabilla (V)
20	Royston (C)	51	Eton (V)
21	Andergrove (V)	52	Palmyra (C)
22	Neils (C)	53	Brightley (V)
23	Habana (V)	54	Wollingford (V)
24	Etowrie (V)	55	Mentmore (C)
25	Glenella (V)	56	Silent Grove (V)
26	Farleigh (V)	57	Murray (V)
27	Marian (V)	58	Kungurri (V)
28	Martin (V)	59	Mirani (V)
29	Benholme (UC)	60	Wollingford (V)
30	Dunwold (C)	61	Sandiford (V)
31	Kuttabul, alluvial-colluvial variant (C)		

C - Cleared; UC - Uncleared; V - Cultivated.

Plate 1. A road cutting near Uruba has exposed one of the many dykes in the Urannah Igneous Complex.

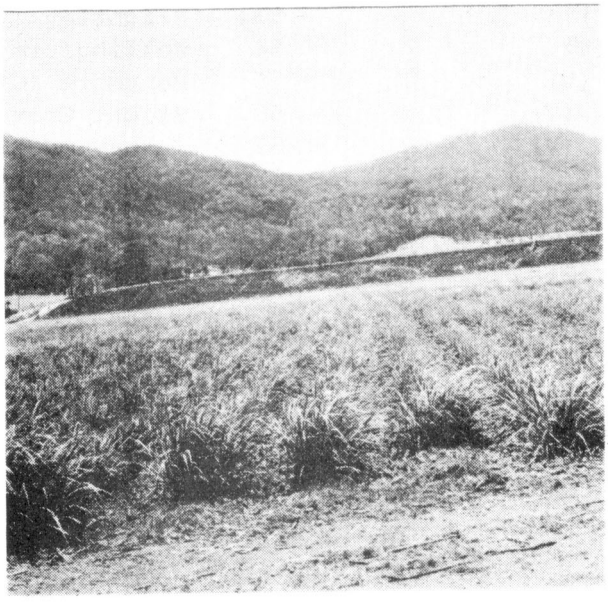

Plate 2. The alluvial-colluvial slopes from west of Finch Hatton east to Pinnacle have been truncated by Cattle Creek.

Plate 3. A cemented pan underlies the Kinchant soil of the relict plains.

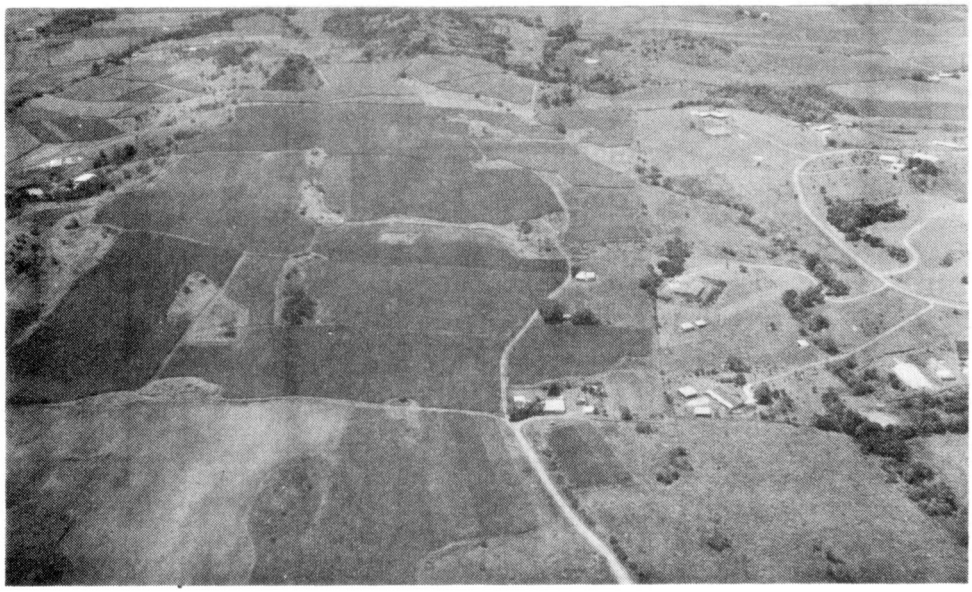

Plate 4. Steep, stony but fertile land north of Mackay.

Soil pH

Surface 0 to 100 mm soil pH values range from very strongly acid to slightly acid (pH 4.8 to 6.5). The mean 0 to 100 mm pH is pH 5.7 $\pm$ 0.44. The low standard deviation indicates the uniformly acid surface pH values of this area. The only alkaline surface pH (pH 7.9) was on the mound of a gilgai in the Victoria Plains soil.

Using the pH of the lowest horizons given in the soil profile class descriptions (Appendix IV), and the area of mapping units (Table 6), the areas of soils with acid (pH 6.5), acid to neutral pH, neutral (pH 6.5 to 8.0), neutral to alkaline and alkaline (pH 8.0) pH in their lowest horizons was calculated. This data shows 19% of the area mapped has soils with acid pH, 35% has acid to neutral pH, 10% has neutral pH, 8% has neutral to alkaline pH and 28% has alkaline soils.

The soil pH reaction trends for the representative profiles of soils within the Mackay landscape units are given in Table 8.

Neutral to alkaline reaction trends are mainly associated with the duplex and uniform clay soils of the alluvial plains, the soils derived from alluvial-colluvial material from basic to intermediate volcanics and soils derived from sedimentary rocks.

Soils most strongly acid at depth are the Munbura (pH 5.1), the Marwood (pH 5.2) and the Kinchant (pH 5.2). Plant growth on these soils could be adversely affected by the release of plant available aluminium if the pH is allowed to drop below 5.0. Soil ameliorants such as lime or dolomite may benefit these soils by preventing a lowering of the pH which can occur following the addition of nitrogenous fertilisers. Rayment and Wallis (1981) found that for pigeonpea growing on Fiji soils, fair to good growth occurred on soils with a pH range of 5.0 to 5.4 but poor growth due to increased aluminium availability was observed on soils with lower pH (4.5 to 4.7).

Salinity and sodicity

No soils are classified as saline in either the surface or subsoil according to the criteria of Northcote and Skene (1972). The majority of the soils have low electrical conductivity (EC) and chloride values throughout the profile. However, some profiles do have medium levels of conductivity at depth (see Table 9). The Dundula soil is the only soil to have a high EC of 1.2 mS/cm (at 1 200 mm) and a chloride of 1 800 ppm, which accounts for 90% of the measured soluble salts. Similar trends for low profile salinity levels were found in the Proserpine district by Thompson *et al.* (1981) and they suggest this reflects a strongly leached soil environment. Gypsum was not found in any profiles.

Table 8. Soil pH reaction trends for the Mackay landscape units

Landscape unit	No. of Profiles	Depth (mm)	pH Range	pH Mean*
Soils of uplands derived from acid crystalline tuffs	(2)	0-100 1 100-1 200	5.6-5.8 5.1-5.2	5.7 5.1
Soils of uplands derived from acid to intermediate intrusives and dykes				
sedentary and alluvial-colluvial soils with coarse surface textures	(4)	0-100 1 100-1 200	5.2-5.9 6.0-7.4	5.6 6.5
sedentary and alluvial-colluvial soils with medium to fine surface textures	(6)	0-100 1 100-1 200	5.1-5.9 5.3-6.7	5.5 6.3
Soils of uplands derived from basic to intermediate volcanics				
sedentary soils	(9)	0-100 1 100-1 200	5.0-6.0 5.4-8.6	5.7 -
alluvial-colluvial soils	(3)	0-100 1 100-1 200	5.3-6.2 8.2	5.9 8.2
Soils of uplands derived from acid to intermediate volcanics	(5)	0-100 1 100-1 200	5.3-5.8 5.6-8.8	5.6 -
Soils of uplands derived from sedimentary rocks	(6)	0-100 1 100-1 200	5.2-5.9 5.3-9.6	5.6 -
Soils of alluvial-colluvial plains derived from acid to intermediate volcanics and sedimentary rocks	(3)	0-100 1 100-1 200	5.4-6.0 6.4-7.4	5.7 6.8
Soils derived from Quaternary alluvium				
duplex soils of alluvial plains	(9)	0-100 1 100-1 200	5.0-5.9 6.3-8.9	5.6 -
uniform clays of alluvial plains	(4)	0-100 1 100-1 200	5.4-7.9 7.5-8.5	- 8.1
duplex soils of relict plains	(4)	0-100 800-900	5.2-6.1 5.4-9.8	5.6 -
soils of levees, terraces and floodplains	(4)	0-100 500-600	4.8-5.6 5.0-5.7	5.2 5.4
Soils of the beach ridges and coastal dunes	(2)	0-100 1 100-1 200	5.6-6.1 5.9-6.8	5.8 6.4

* Mean pH values are not given for landscape units with both acid and alkaline soil reaction trends.

Chloride accounts for 70% of the soil soluble salts in all but two of the sites analysed. These sites, Jumper and Allandale, strongly sodic variant, have less than 60% of the soluble salts present as chloride. Very strongly alkaline pH is associated with these soils probably indicating the presence of other ions such as carbonate and bicarbonate.

Chloride profiles are illustrated in Figure 4 for soils derived from Quaternary alluvium. Mirani soil represents the majority of Mackay soils which have low to very low EC and chloride levels. The Dundula soil is situated near mangroves and has high EC and chloride levels. The Narpi and Benholme soils have some chloride present in their profiles but indicate strong leaching to 900 mm.

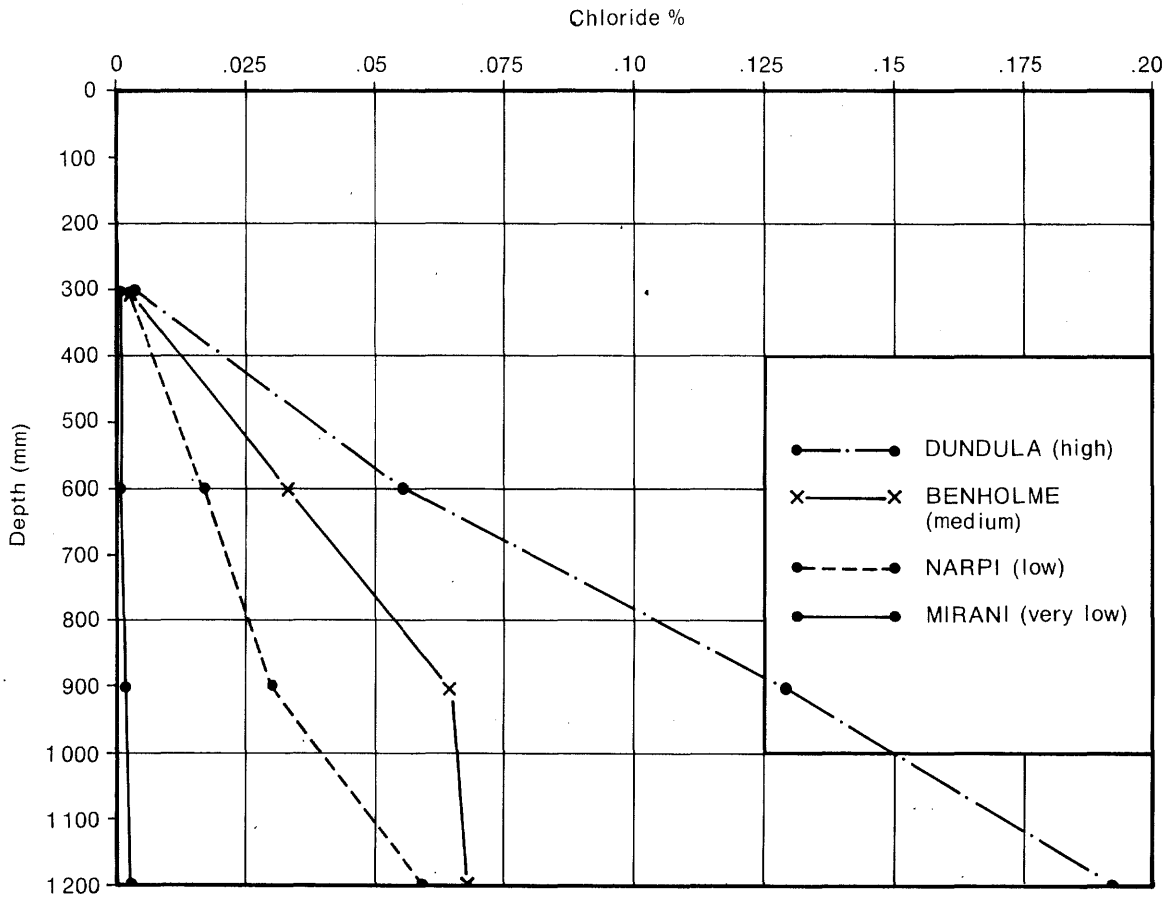

Figure 4 Chloride profiles for selected soils on Quaternary alluvium with very low, low, medium and high E.C. values

Table 9. Selected chemical data for soils with medium to high electrical conductivity values (≥.45 mS/cm), or with strongly sodic subsoils (ESP > 15)

Soil	Depth (mm)	EC (mS/cm)	ESP	Ca/CEC	Mg/CEC %	Mg/Ca
Soils of uplands derived from basic to intermediate volcanics						
alluvial-colluvial soil						
	500 - 600	.32	12	.5	58	1.2
Etowrie	800 - 900	.51	15	.4	50	1.3
	1 100 - 1 200	.51	17	.4	48	1.2
Soils of uplands derived from acid to intermediate volcanics						
	500 - 600	.33	24	.05	51	9.5
Whiptail	800 - 900	.34	45	.02	62	25.8
	1 100 - 1 200	.47	49	.01	46	55.0
	500 - 600	.02	4	.3	27	1.0
Wollingford (S60)*	800 - 900	.05	9	.4	39	1.0
	1 100 - 1 200	.19	15	.4	45	1.0
Soils of uplands derived from sedimentary rocks						
	450 - 550	.02	5	.02	19	12.5
Pindi	800 - 900	.06	9	.002	19	96.0
	1 100 - 1 200	.12	16	.001	24	190.0
	500 - 600	.10	18	.3	62	2.4
Jumper (S3)	800 - 900	.30	29	.2	62	3.1
	1 100 - 1 200	.45	39	.1	68	4.8
Jumper (S5)	500 - 580	.27	48	.1	41	2.0
Soils of alluvial-colluvial plains derived from acid to intermediate volcanics and sedimentary rocks						
	400 - 500	.03	6	.2	14	0.6
Ossa	800 - 900	.12	13	.4	22	0.5
	1 100 - 1 200(D)+	.17	17	.4	21	0.5
	500 - 600	.03	7	.3	27	1.1
Balberra	800 - 900	.09	12	.4	38	0.9
	1 100 - 1 200	.21	15	.4	40	1.0
Soils derived from Quaternary alluvium						
duplex soils of alluvial plains						
	500 - 600	.03	9	.2	49	2.8
Calen (S2)	800 - 900(D)	.10	24	.3	71	2.7
	1 050 - 1 100(D)	.15	27	.2	64	3.1
	500 - 600	.14	5	.4	40	.9
Eton	800 - 900	.33	10	.4	52	1.3
	1 100 - 1 200	.46	14	.3	54	1.7
uniform clays of alluvial plains						
	500 - 600	.20	5	.6	26	.4
Benholme	800 - 900	.46	8	.7	30	.5
	1 100 - 1 200	.51	10	.6	29	.5
	500 - 600	.32	11	.2	48	2.3
Dundula	800 - 900(D)	.78	16	.2	64	3.3
	1 100 - 1 200(D)	1.3	20	.2	67	3.2
duplex soils of relict plains						
	500 - 600	.02	12	.01	20	25.0
Kinchant	800 - 900	.07	19	.02	35	14.4
	1 100 - 1 200	.23	26	.02	39	22.3
	500 - 600	.14	7	.2	42	1.9
Allandale	800 - 900	.46	12	.3	56	2.1
	1 100 - 1 200(D)	.33	24	.3	54	2.0
	400 - 500	.20	96	.03	13	4.1
Allandale, strongly sodic variant	750 - 850	.17	70	.02	6	3.1
	1 100 - 1 200(Pan)	.15	87	.01	6	5.8

* S60 - site number; + (D) - buried layer;

For purposes of defining sodicity or exchangeable sodium percentage (ESP) the criterion of Northcote and Skene (1972) has been used. ESP's of 8 to 11 were calculated for the surface layers of the Septimus and Kinchant, coarse sandy variant soils. Although the levels of ESP classify these soils as sodic the analytical errors associated with exchangeable sodium values lower than 0.5 meq/100 g explain the obviously misleading results. The surface layers of all other soils are non sodic (ESP < 6).

Nineteen of the 61 profiles analysed had sodic subsoils (ESP 6 to 14) and a further nine had strongly sodic subsoils (ESP 15). The latter are presented in Table 9. The Allandale, strongly sodic variant soil has a maximum ESP of 96 at 600 mm depth.

Soil Survey Staff (1951) have indicated that advanced weathering of clays releases magnesium especially, and that in solodized solonetz soils most of the exchangeable sodium may have been lost. The same process may occur in soloths. Teakle (1950) has described a soil near Cardwell, north Queensland, which has 83% magnesium saturation of the total exchangeable cations and a low ESP; as a magnesium soloth. Thompson *et al.* (1981) also identified a soloth at Proserpine with 85% magnesium saturation, low ESP and columnar structure. The Seaforth soil profile has 64% magnesium saturation of the exchangeable cations and an ESP of 5 at depth. Similar levels are recorded for a soloth in the Glenelg region of Victoria (Stace *et al.* (1968), p. 185). The profile morphology of the Seaforth soil may be due to the magnesium levels.

The Sunnyside soil appears to be an anomaly. Its morphological properties fit the solodic - solodized solonetz soils, but the ESP is less than 1% and magnesium reaches only 38% saturation. van Wijk (unpublished data) has previously sampled a profile with similar morphology and in a similar topographic position adjacent to the study area at Alligator Creek. This profile has similar physical and chemical properties but with ESP's of 9 to 18% and magnesium saturation of 53 to 55% in the subsoil. Further profiles need to be analysed to clarify this anomaly.

In contrast, Wagoora and Pindi soils have friable and moderately permeable clay subsoils which become sodic to strongly sodic below 900 mm. Wagoora may be classified as a prairie soil on morphological features but has an ESP of 14 with 56% magnesium saturation of the exchangeable cations at 1 400 mm depth. Stace *et al.* (1968) have also described a soil at Bundaberg, Queensland, with similar properties as a prairie soil (p. 139). The Pindi soil is strongly sodic (ESP of 16) at 1 200 mm depth but the B horizon is friable to auger and has prismatic breaking to fine to medium blocky structure.

Magnesium to calcium ratio and dispersion ratios

Mg:Ca ratios were used by Emmerson and Bakker (1973) for assessment of the physical performance of some Victorian soils. They suggested that Mg to Ca ratios greater than one, associated with relatively low ESP, can cause clay dispersion, particularly in illitic soils. Leverington (1955) found illite to be a major clay constituent of some duplex soils in the Mackay district.

Mg:Ca ratios vary widely in the clay subsoils of duplex profiles at Mackay. There is a poor correlation between the Mg:Ca ratio and the dispersion ratio described by Bruce and Rayment (1982). Examples of this poor correlation include the Pindi soil which has the high Mg:Ca ratio at 900 mm depth of 96:1, but has only a moderate dispersion ratio of 0.62. In contrast, the Sunnyside soil has a 0.7:1 (Mg:Ca) ratio at 900 mm depth and a very high dispersion ratio of 0.98. Moreover, the Marian soil has a similar Mg:Ca ratio (0.6:1), but a low dispersion ratio of 0.48 at the same depth.

Bruce and Crack (1978) found Mg:Ca ratios in excess of 5:1 common for duplex soils in Queensland. Thompson *et al.* (1981) found ratios of 1.0 to 1.5 Mg:Ca in solodics at Proserpine while soloths varied from 5 to 30. At Mackay ratios vary from 0.7 to 6:1 for solodic - solodized solonetz soils and from 0.5 to 190:1 for soloths at 1 200 mm depth.

Cation exchange capacity, base saturation and cations (Ca, Mg and K)

The cation exchange capacity (CEC) and base saturation vary considerably over the suite of Mackay soils. The deep sandy soils of Marwood, Andergrove, Neils and Kinchant, coarse sandy variant have CEC's of 5 meq/100 g throughout the profiles. The CEC values would be even lower if determined at field pH as the soils are medium to strongly acid, except for the Neils soil which has a neutral pH. The CEC method used (Bruce and Rayment 1982) over-estimates CEC in acid soils, especially in the upper horizons containing high levels of organic matter.

The highest CEC's occur in the fine textured Victoria Plains and Brightley soils on alluvium, Silent Grove soil on alluvium-colluvium and the Royston and Wagoora, basic parent material variant (sample site 7) soils developed on basic to intermediate volcanics. They have A horizon CEC's of 36 to 57 meq/100 g and B horizons values 31 to 72 meq/100 g. The high CEC in the A horizon of the medium textured Kowari soil (42 to 44 meq/100 g) is probably related to the high organic carbon levels of 5.0 to 6.7%.

The base saturation of A horizons is generally less than that of B horizons. The mean base saturation of the 0 to 100 mm samples is 42% while that for the 500 to 600 mm samples is 65%. The lower depth samples from Netherdale soil have high base saturations of 140 to 160%. These could be due to cation release from primary minerals in the decomposing C horizon. Eleven profiles have highly base unsaturated B horizons (< 30%) and are all acid to strongly acid.

There are 38 sites that have not been previously cultivated for cane production although four of these sites have probably received some applications of superphosphate fertilises on improved pastures.

Exchangeable calcium, magnesium and potassium levels for the 0 to 100 mm soil layers vary considerably with the major determinant of levels being soil texture. The mean and standard deviation of the Ca, Mg and K levels for coarse textured surface soils (sand to light sandy clay loam) and for finer textures, both fertilised and unfertilised, are shown in Table 10. The coarse textured soils generally have much lower levels. Although the data is inconclusive there appears to be little effect from fertiliser on levels except perhaps on the Ca levels in coarse textured soils.

Table 10. Exchangeable Ca, Mg and K levels for the 0 to 100 mm layer of coarse and finer textured soils, fertilised and unfertilised

	Coarse texture			Finer texture		
	Ca	Mg meq/ 100 g	K	Ca	Mg meq/ 100 g	K
Fertilised	2.06 ± 1.61	0.92 ± 0.58	0.24 ± 0.09	4.84 ± 4.6	2.92 ± 2.34	0.37 ± 0.21
Unfertilised	1.29 ± 0.81	0.84 ± 0.47	0.19 ± 0.14	4.81 ± 4.44	3.24 ± 3.02	0.3 ± 0.23

Total potassium and phosphorus

The total potassium levels in sedentary and alluvial-colluvial soils are variable and related mainly to parent material. Sedentary soils developed on granite such as the Dunwold and Septimus soils have total potassium levels of over 2%, whereas soils developed on intermediate volcanics such as the Wagoora, Royston and Nabilla soils have levels less than 0.5%.

There appears to be a good correlation between age and total potassium levels for soils developed on Quaternary alluvium. The provenance of the alluvium is dominated by the Urannah complex and so it is reasonable to assume there has been a consistent supply of potassium to the older and younger alluvium.

Figure 5 shows the total potassium levels down the profile for four groups of soils developed on Quaternary alluvium. The youngest soils, those on the levees, terraces and flood plains have the highest levels of total potassium followed by the duplex soils of the alluvial plains, the uniform clays and lowest levels are found in soils developed on the relict plains.

McDonald (pers. comm.) found a similar trend for soils at Emerald as did Thompson *et al.* (1981) for soils at Proserpine. The total potassium levels of the soils on Tertiary sediments at Proserpine are of the same order as the soils developed on the relict plains. This indicates the relict plains may be of Tertiary age.

Total phosphorus levels generally decrease down the profile. A similar pattern to total potassium levels in soils derived from alluvium is evident in Figure 6. The younger terrace soils have levels of 0.04 to 0.03% compared to the older duplex soils with levels of 0.025 to 0.15%. The soils of the relict plains have extremely low levels 0.01 to 0.004%

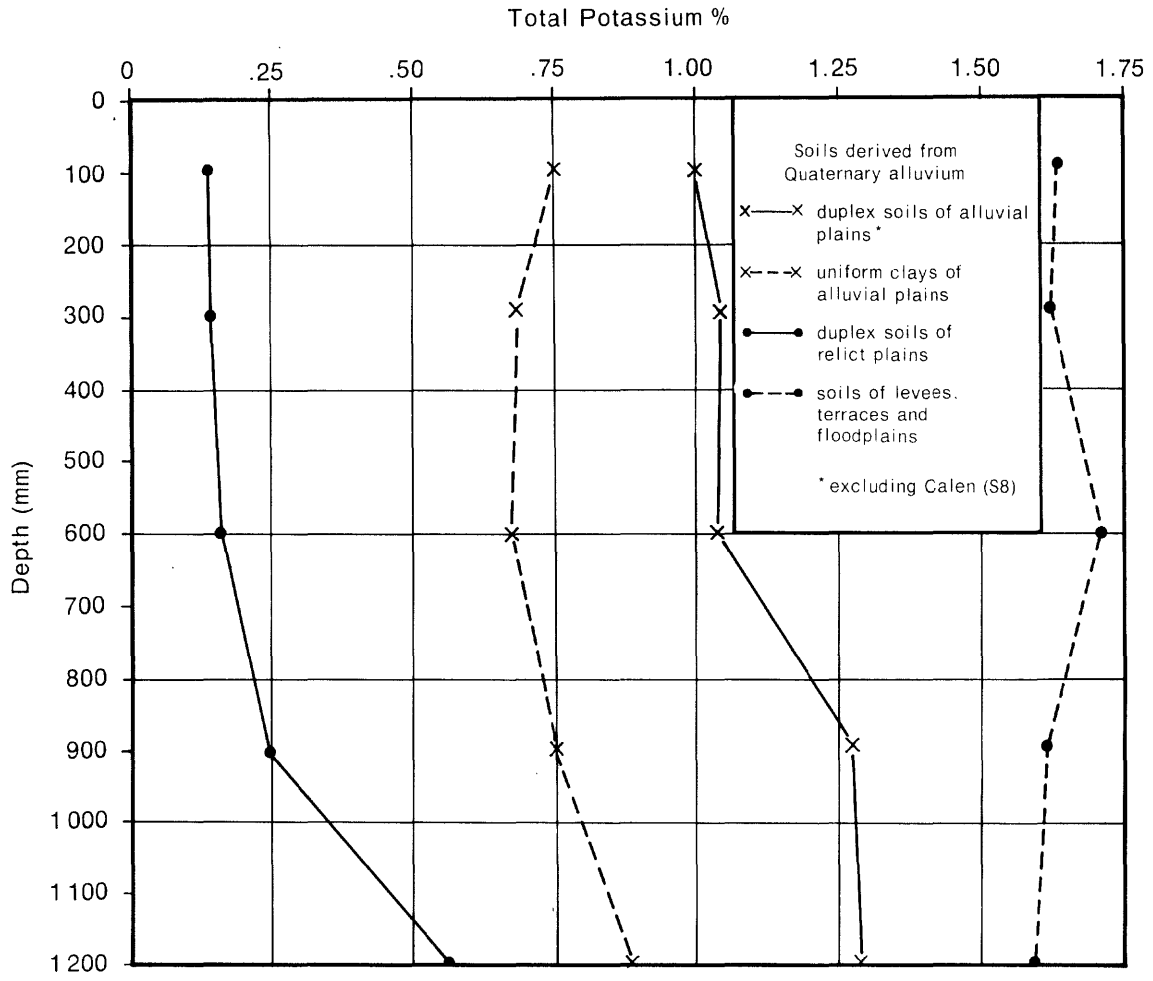

Figure 5 Total potassium profiles for soils derived from Quaternary alluvium

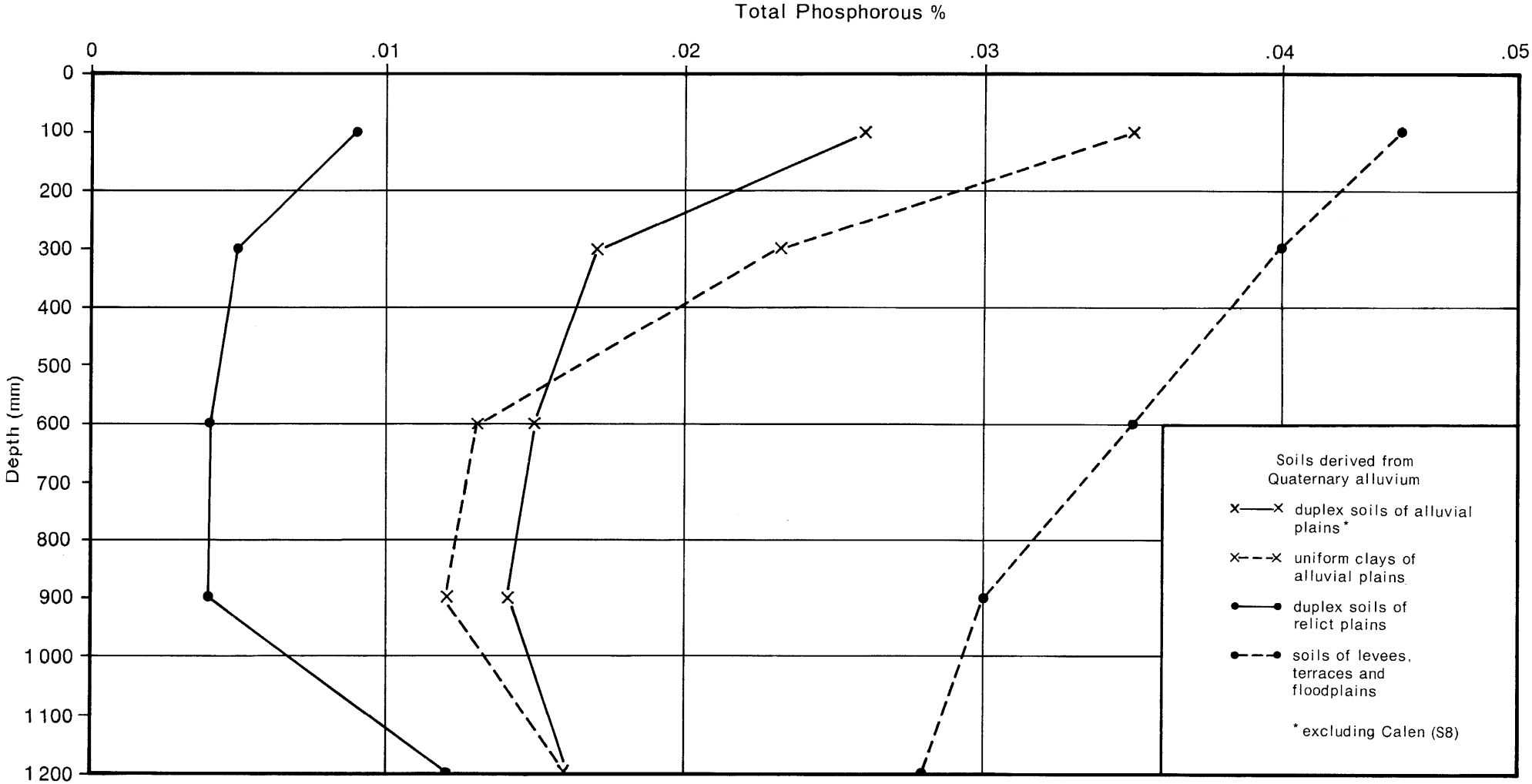

Figure 6 Total phosphorous profiles for soils derived from Quaternary alluvium

Levels in sedentary soils vary from 0.05 to 0.03% for soils developed on parent materials such as granodiorite and intermediate volcanics to 0.02 to 0.015% for soils developed on sediments and granite to 0.01% for soils developed on acid crystalline tuffs.

Available soil water capacity

The available soil water capacity (ASWC) is usually calculated using -1/3 and -15 bar water contents. Gardner (1971) claims that the -1/3 bar water content is not reliable for estimating the ASWC on machine ground (< 2 mm) clay soil samples.

Table 11 shows the calculated plant available water (PAW) for eleven profiles using the method of Shaw and Yule (1978). The calculated PAW was converted to volumetric water using a bulk density calculated from maximum gravimetric water content. The differences were then summed to the depth of maximum rate of increase in chloride concentrations (Shaw and Yule 1978).

Table 11. Calculated plant available water for eleven soils

Soil	Calculated PAW (mm)
Narpi	133
St Helens	122
Pindi	133
Cameron	112
Seaforth	125
Belmunda	120
Wagoora	139
Ossa	122
Mulei	116
Kuttabul	136
Royston	141

Particle size analysis

Figures 7 and 8 show the clay percentages down the profile for selected duplex and clay soils. The highest clay contents in the B horizons of the duplex soils are at the 500 to 600 mm sample depths. The increase in clay content at 1 100 to 1 200 mm in the Sandiford profile is due to a buried layer.

The clay soils generally have A horizon clay contents around 40 to 50% increasing to 60 to 70% down the profile. The sedentary Royston soil shows a decline in clay content below 300 mm as decomposing parent material is encountered at shallow depth.

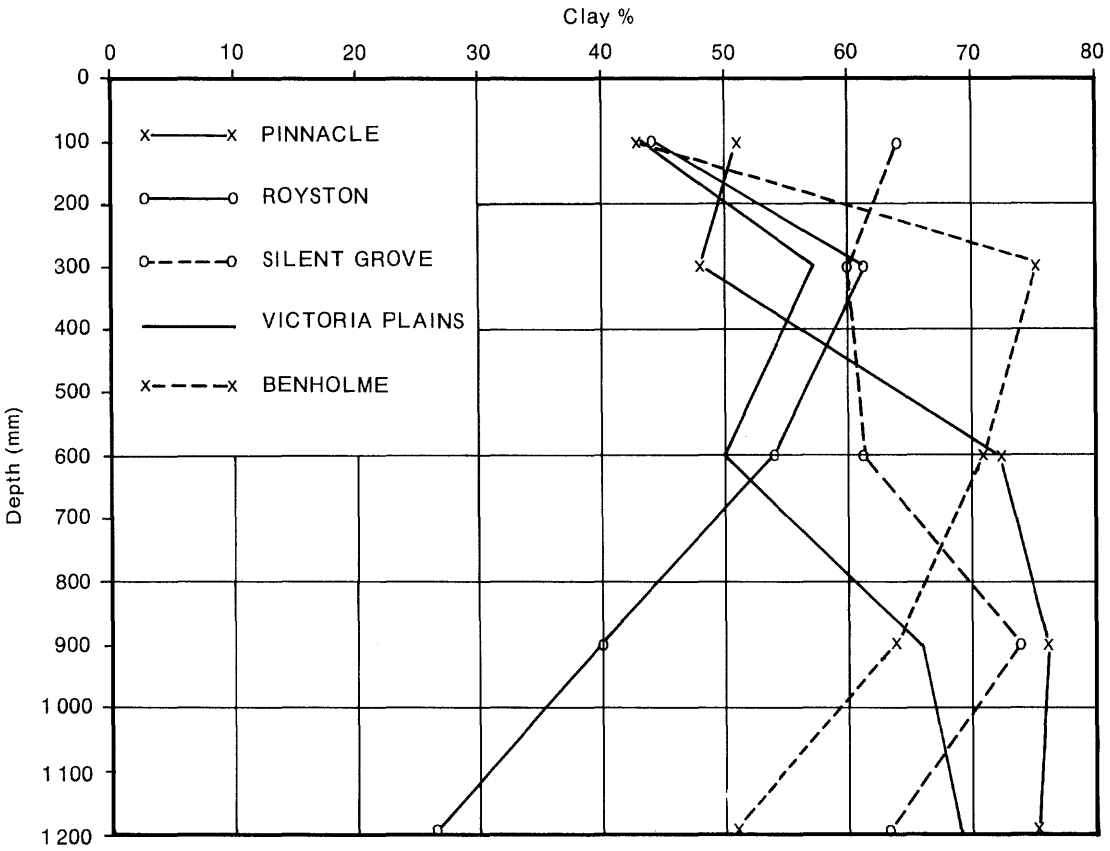

Figure 7 Clay percentage of selected clay soil profiles

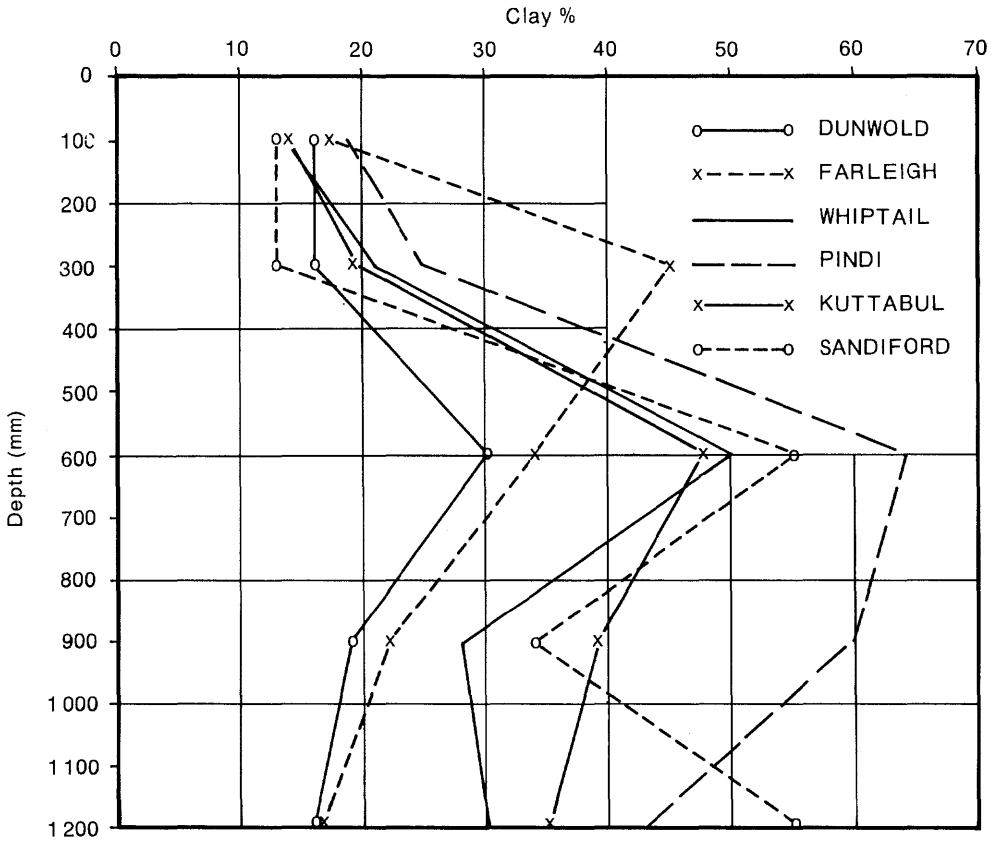

Figure 8 Clay percentage of selected duplex soil profiles

Clay activity ratio

The clay activity ratio (CEC/clay) m. equiv. per g clay, was calculated for the 500 to 600 mm and 800 to 900 mm samples. Results indicate most clay B horizons have activity ratios of around 0.4 to 0.5. The highest ratios of around 0.8 to 1.0 were in soils such as Wagoora, basic parent material variant, Royston, Kungurri and Silent Grove which are associated with intermediate to basic volcanics. The alluvial clay soils had ratios of 0.7 to 0.6.

Of particular interest is the Pinnacle soil which has around 70% clay and an activity ratio of only 0.1, indicating that kaolin is the dominant clay mineral. The Munbura and Neils soils also have low ratios of 0.1 to 0.2.

Soil fertility

Chapman *et al.* (1981) gives critical soil nutrient levels for sugar cane growing as 'deficient' where 'a yield response to fertiliser application is most probable' and 'marginal' where 'crop responses are less likely to occur'. The chance of a yield response from fertiliser is only slight if soil nutrient levels are above the marginal levels. These levels are given in Table 12.

Table 12. Critical soil nutrient levels for sugar cane (Chapman *et al.* 1981)

Soil nutrient	Deficient	Marginal	Unit
P	5	5 - 20	ppm
K (after harvest)	0.12	0.12 - 0.20	meq/100 g
K (after fallow)	0.17	0.17 - 0.25	meq/100 g
Ca	0.5	0.5 - 1.5	meq/100 g
Mg	0.08	0.08 - 0.3	meq/100 g
SO_4^- S	5	5 - 10	ppm
Cu	0.3	0.3 - 0.5	ppm
Zn	0.8	0.8 - 5.0	ppm
Fe	5	5 - 10	ppm
Mn	5	5 - 10	ppm

These critical levels approximate the low to very low general ratings of Bruce and Rayment (1982).

Interpretation of soil nutrient levels is highly problematic especially with sugar cane. Chapman (1982) found poor correlations between soil analyses for N, P and K and yield responses. Haysom (pers. comm.) suggests the 12 month crop cycle and thus the long period over which the cane plant can 'forage' for nutrients, makes the levels of soil nutrients, particularly trace elements, less critical for sugar cane than for other crops with shorter growing periods.

Soil fertility ratings for the 0 to 100 mm layers of soils in the landscape units are given in Table 13. Fertility ratings within landscape units vary considerably but the soils derived from crystalline acid tuffs, the soils of the relict plains and the soils of the coastal dunes and beach ridges all have low fertility. Soils with medium to high fertility include the uniform clays of the alluvial plains and soils derived from intermediate to basic volcanics.

The extractable phosphorus (acid P) levels of fertilised and unfertilised profiles were compared. Phosphorus levels in the 0 to 100 mm sample were 10 ppm or less for 31 of the 34 unfertilised sites. The Kowari soil is unique with P levels in excess of 300 ppm.

Seventeen of the 27 fertilised sites had acid P levels in excess of 20 ppm with only three sites having less than 10 ppm.

Organic carbon levels (uncorrected Walkley and Black) were compared between 24 permanently cultivated and 37 non-cultivated sites for the 0 to 100 mm layers. The permanently cultivated sites have a mean level of 1.1% C ranging from 0.3 to 2.7% C. The non-cultivated sites have a mean level of 1.6% C ranging from 0.7 to 6.7% C. Whether a drop of 0.5% C in the cultivated soils is significant to soil workability and soil fertility is as yet unknown.

The organic carbon levels are lower in soils with coarse surface textures. The Kowari soil has the highest level of 6.7% C.

Carbon : nitrogen ratios vary considerably between soils. There appears to be no pattern within landscape units or between cultivated and non-cultivated sites. The mean C:N ratio for all soils is 13.9:1 in the surface 100 mm with a range from 6:1 to 24:1. Probert (1977) calculated a mean ratio of 13.5:1 for some north Queensland soils but also with considerable variation.

Thompson *et al.* (1981) report C:N ratio means of 16:1 to 19:1 for soil groups of the Proserpine lowland. Blakemore and Miller (1968) associated high C:N ratios with infertile soils in New Zealand and Thompson *et al.* (1981) report a similar pattern for Prosperine soils. However, Kowari (non-cultivated) and St Helens (cultivated) are two of the most 'fertile' soils in Mackay and also have the highest ratios, 24:1 and 20:1 respectively. Probert (1977) also found high ratios for soils not considered 'infertile'.

Total sulphur levels decrease with depth in nearly all soil profiles analysed. However, Chapman *et al.* (1981) found that sulphate sulphur levels marginally increased with depth. Most soils have total sulphur levels of less than 0.02% with coarse textured soils often having levels less than 0.01%. The highest level, exceeding .05%, was recorded in the Kowari soil.

Soils with coarse surface textures have low Cu levels 0.1 to 0.3 ppm and yield responses in sugar cane to applications of copper sulphate have occurred in some areas. Most other soils have levels of 0.3 to 5 ppm.

Zinc levels are low (0.2 to 0.5 ppm) in the Marwood, Munbura, Septimus, Gargett, Pinnacle, Sandiford, Andergrove and Allandale, strongly sodic variant soils. Other soils have adequate levels.

Manganese levels range from 4 to 345 ppm with most soils having medium to high levels. Soils with levels less than 10 ppm include Marwood, Mulei, Mirani, Kinchant, Allandale, strongly sodic variant and Andergrove.

The iron levels which range from 18 ppm to 280 ppm are considered adequate for sensitive crops (Viets and Lindsay 1973).

Calcium levels are generally adequate but some 16, 0 to 100 mm layer samples have levels less than 1.5 meq%. Yield responses in sugar cane to calcium fertiliser (dolomite, lime, gypsum) have occurred, particularly on coarse textured soils.

Magnesium levels of less than 0.3 meq% in the 0 to 100 mm layer samples occur in the Septimus and Andergrove soils.

In the Mackay district, no yield responses in sugar cane have been observed to applications of iron, magnesium, zinc or sulphur (Haysom pers. comm.).

Table 13. Soil fertility ratings for landscape units (0 to 100 mm layer)

Landscape unit	Organic carbon	Phosphorus *Acid-P	Potassium Exch K*	Sulphur Total S	DTPA Fe[1]	Extractable elements Mn	Cu	Zn
Soils of uplands derived from acid crystalline tuffs	low	v. low	v. low	low	adequate	medium	low	low
Soils of uplands derived from acid to intermediate intrusives and dykes -								
coarse surface textures	v. low - low	v. low - high	low - medium	v. low - low	adequate	medium	low - medium	low - medium
medium to fine surface textures	low - v. high	v. low - v. high	medium - high	low - high	adequate	medium - high	medium	medium
Soils of uplands derived from basic to intermediate volcanics	low - high	v. low - high	low - high	low - medium	adequate	medium - high	medium - high	medium
Soils of uplands derived from acid to intermediate volcanics	low - medium	v. low	low - high	low - medium	adequate	medium - high	medium - high	medium - high
Soils of uplands derived from sedimentary rocks	low - medium	v. low	v. low - low	low - medium	adequate	medium	low - medium	medium
Soils of alluvial-colluvial plains derived from acid to intermediate volcanics and sedimentary rocks	low	v. low	low	low	adequate	medium	low - medium	medium
Soils derived from Quaternary alluvium								
duplex soils of alluvial plains	low	v. low	low	low	adequate	medium - high	medium	medium
uniform clays of alluvial plains	medium	v. low - high	medium - high	low - medium	adequate	medium - high	medium	medium
duplex soils of relict plains	low	v. low	low - medium	low	adequate	medium	low	low - medium
soils of levees, terraces and flood plains	v. low - low	#	#	low	adequate	medium - high	medium	medium
Soils of the beach ridges and coastal dunes	low	#	#	low	adequate	medium	low	low - medium

* For non-cultivated sites only
\# All sites are cultivated
1 This rating is based upon Viets and Lindsay (1973), all other ratings are from Bruce and Rayment (1982)

10. LAND DEGRADATION

10.1 Salinity and sodicity

At this stage no definitive work has been completed on the types and causes of salinity and sodicity in the Mackay district. To date, the total area affected has been estimated at 400 ha, and is increasing.

Three broad categories of affected soils have been recognised. These include problems caused by sea water intrusion, by shallow water tables and seepages associated with uplands, and by relict sodic areas.

Sea water intrusion

Soils affected by sea water intrusion have high levels of total soluble salts. Underground water quality has been affected by excessive pumping from aquifers close to the coast which has allowed sea water into previously fresh water aquifers. South of Mackay city the salt water - fresh water interface occurs 1 to 4 km from the coast. Water quality from bores in susceptible areas is monitored, especially in times of low rainfall and pumping is restricted when necessary.

Areas affected by sea water intrusion tend to be larger than seepage areas, often 2 to 10 ha. The total area affected is 80 to 100 ha.

Seepages associated with uplands

Groundwater seepage may result in salt affected soils with either medium to high levels of total soluble salts and/or strongly alkaline pH. The outbreaks are locally referred to as 'soda patches' where the often spectacular effects in sugar cane blocks include no crop growth, extremely hard and intractable soils when dry and wet 'spewey' soils for long periods following rain. These severe symptoms mostly occur in relatively small areas of less than 0.5 ha although outbreaks of 5 ha have been recorded. It is suspected that there must be larger areas which suffer less spectacular growth restrictions and so go undetected.

There is a good correlation between geological formation and susceptibility to outbreaks. The Urannah Igneous Complex and Calen Coal Measures have little secondary salting associated while the Carmila Beds, Lizzie Creek Volcanics and Campwyn Beds each have potential for the development of secondary salting. The outbreaks usually occur in footslope positions often at the boundary between Victoria Plains or Calen soils and sodic upland soils such as Wollingford, Whiptail or Jumper. Soils developed on intermediate

volcanics such as Nabilla and Glenella, may have secondary salting developed in lower slope positions. Within the study area there is approximately 150 ha severely affected by seepage salting and sodicity.

Ameliorative measures recommended by the BSES include gypsum applications, together with subsurface drainage. The aim is to improve profile drainage, lower water tables, displace sodium ions from the exchange complex and leach the profile.

Relict sodicity

Relict sodic areas occur south of Marian, and near Palmyra. These areas developed prior to land clearing and supported only depauperate plant communities. The profiles have low levels of salts, but the cation exchange complex is dominated by sodium and the B horizon is strongly alkaline. There are approximately 150 ha affected.

10.2 Soil erosion

The extent of existing soil erosion was recorded for each uma suitable or marginally suitable for agriculture. Current erosion is difficult to assess in cane land because the regular cultivation and landscaping undertaken by farmers tends to disguise the effects of erosion. Evidence for erosion includes rills down furrows, soil deposition, exposed B horizons or unusually shallow A horizons and gullies. Stream bank erosion is also difficult to assess due to limited access to streams.

There are 1 740 ha suffering severe, accelerated soil erosion. This is mainly due to rill erosion in cane inter-rows oriented down the slope, especially in highly erodible soils such as Dunwold and Kuttabul.

Gully erosion is generally not severe in this district with most occurrences due to poor farming practices where water is concentrated into headlands and inappropriate waterways. The most serious gully erosion occurs in those soils with sodic B horizons.

Some 23 600 ha have observable, though not severe, symptoms of erosion, again due mainly to rill erosion in inter-rows of cane land. There was little evidence of extensive erosion in grazing lands, the problems in these areas being primarily associated with roads and tracks.

34 100 ha of erodible land show little evidence of erosion but probably suffer minor rill erosion. Minor gully erosion may occur where water disposal is poorly designed. These less eroding lands require soil conservation measures to stabilise the land surface and maintain the productive potential of the soil.

Streambank erosion is not a major problem but there have been isolated serious problems along St Helens, Murray and Cattle Creeks.

The total area of land which requires soil erosion control measures is approximately 66 500 ha. By the end of 1983 some 4 500 ha of cane land will have contour banks or other soil erosion control measures implemented.

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APPENDIX I

Explanation of codes for the uma data file

Location

Eastings. Australian Map Grid (AMG) reference for a labelling point within the unique map area (uma).

Northings. AMG reference for the same point within the uma.

Zone. A code for the zone designation of the AMG. The survey area is entirely within zone SF55 coded as 55.

Resource inventory

Uma number. A numeric code assigned sequentially from the first uma described through to the last (1 to 9999).

Mapping unit name. Based on the dominant soil (soil profile class). Symbols are from the reference on the soils map.

Geological reference. Map symbols from the Proserpine and Mackay 1:250 000 geological series.

Parent material. Indicates alluvial-colluvial material.

Soils - variability.

1. Relatively homogenous, similar agricultural soils associated.
2. Relatively homogenous, dissimilar agricultural soils associated.
3. Relatively heterogenous, similar agricultural soils associated.
4. Relatively heterogenous, dissimilar agricultural soils associated.

Associated soils. Codominant and/or minor associates.

Slopes. Minimum, modal and maximum slopes of the uma estimated in per cent.

Erosion assessment (EA).

0 - no significant water erosion.
1 - little evidence of erosion; land probably suffers minor sheet and rill.
2 - observable erosion; including soil deposition, minor gullies, eroded furrows and exposed subsoil in cultivation.
3 - severe erosion; gullies developed.
4 - streambank erosion.

Landform.

Erosional terrain -

		Relative relief	Slope
LP	Level plain	< 9 m	< 1%
GP	Gently undulating plain	< 9 m	1 - 3%
UP	Undulating plain	< 9 m	3 - 10%
RP	Rolling plain	< 9 m	10 - 32%
B	Badlands	< 9 m	> 32%
GR	Gently undulating rises	9 - 30 m	1 - 3%
UR	Undulating rises	9 - 30 m	3 - 10%
RR	Rolling rises	9 - 30 m	10 - 32%
SR	Steep rises	9 - 30 m	32 - 56%
B	Badlands	9 - 30 m	> 56%
UL	Undulating low hills	30 - 90 m	3 - 10%
RL	Rolling low hills	30 - 90 m	10 - 32%
SL	Steep low hills	30 - 90 m	32 - 56%
VL	Very steep low hills	30 - 90 m	56 - 100%
B	Badlands	30 - 90 m	> 100%
UH	Undulating hills	90 - 300 m	3 - 10%
RH	Rolling hills	90 - 300 m	10 - 32%
SH	Steep hills	90 - 300 m	32 - 56%
VH	Very steep hills	90 - 300 m	56 - 100%
PH	Precipitous hills	90 - 300 m	> 100%
RM	Rolling mountains	> 300 m	10 - 32%
SM	Steep mountains	> 300 m	32 - 56%
VM	Very steep mountains	> 300 m	56 - 100%
PM	Precipitous mountains	> 300 m	> 100%

* Source: Speight, J.G. (1984), 'Landform', in 'Australian Soil and Land Survey Field Handbook', McDonald, R.C., Isbell, R.F., Speight, J.G. Walker, J. and Hopkins, M.S. (Inkata Press, North Clayton, Victoria).

Aggraded terrain -

LA	Plain, alluvial
LM	Plain, marine (tidal flat)
FL	Flat, alluvial and alluvial-colluvial, localised
SP	Swamp
DB	Coastal dune, beach ridge and foredune
LE	Levee
TS	Terrace, stream (level 1)
TT	Terrace, level 2
TU	Terrace, level 3
TV	Terrace, level 4
SB	Stream-channel (streambank and bed)

Salt affected soils (SAS).

F - saline/sodic patches associated with uplands; that is, usually footslopes and nearby alluvium.

P - saline/sodic patches on alluvial plain.

I - saline patches due to sea water intrusion.

Land suitability

Limitations to cane production.

m - moisture availability
n - soil nutrient
s - salinity/sodicity
t - topography
k - soil workability
r - stoniness
w - wetness
e - erosion
f - flooding

Land suitability class.

1. Land suitable for long term sugar cane production with no limitations.
2. Land suitable with slight limitations.
3. Land suitable with moderate limitations.
4. Land marginally suitable with severe limitations.
5. Land not suitable for long term production of sugar cane.

Areas

Total area. Total area of each uma.

Estimated assigned area. Estimated existing assigned area in each uma.

Potential assigned area. Estimated potential assigned area in each uma.

Alienated land. Land in each uma used for infrastructure and/or not suitable for cane production.

Identity

Survey code. MCLS - Mackay Sugar Cane Land Suitability Study.

Record type number. Number 23.

APPENDIX III

Common and Scientific Names of Plant Species

Scientific Name	Common Name
Eucalyptus alba	Poplar gum
E. drepanophylla	Queensland grey ironbark
E. intermedia	Pink bloodwood
E. papuana	Ghost gum
E. tereticornis	Queensland blue gum
E. tessellaris	Moreton Bay ash
Melaleuca dealbata	Tea-tree
M. leucadendron	Weeping tea-tree
M. nervosa	Tea-tree
M. viridiflora	Broad leaf tea-tree
Pandanus spp.	Pandanus, screw pine
Planchonia careya	Cocky apple
Tristania suaveolens	Swamp mahogany
Xanthorrhoea johnsonii	Grasstree, black boy

APPENDIX IV

DESCRIPTION OF SOIL PROFILE CLASSES

MARWOOD (Mw)

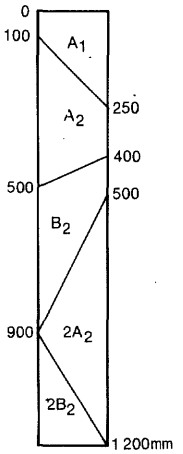
Concept: An acid bleached sand with an iron-organic B_2 horizon in the A horizon of an acid gleyed duplex soil developed on coarse grained acid tuffs and intrusives.

Principal Profile Form: Uc 2.21, 3.21.

Great Soil Group: Podzol developed in A horizon of gleyed podzolic soil.

Parent Material: Rhyodacitic crystal tuffs of Carmila Beds and acid intrusives.

Landform: Gently undulating plains and rises; modal slopes 1-4%.



A_1: Brownish black to brownish grey; brownish grey (dry); loamy coarse sand to coarse sandy loam; single grain; loose; may have 15% angular quartz grit; pH 5.5-6.0. Clear to -

A_2: Brownish grey to greyish yellow brown; brownish grey to light grey (dry); conspicuous to sporadic bleach; coarse sand to coarse sandy loam; single grain; may have 15% angular quartz grit; pH 5.5-6.0. Clear to -

B_2: Bright yellowish brown to dull yellow orange or brown to black; may have 10% medium distinct brown mottles; loamy coarse sand to light sandy clay loam; massive; may have 20% angular quartz grit; pH 5.5-6.0. Abrupt to clear to -

$2A_2$: Greyish yellow brown to light grey; may have 10% medium prominent yellow mottles; conspicuous bleach; coarse sand to loamy coarse sand; single grain; 10-20% angular quartz grit; pH 5.5-6.0. Abrupt to clear to -

$2B_2$: Light grey to greyish white and yellowish brown to bright yellowish brown; may have 25% medium prominent red mottles; coarse sandy clay to medium heavy clay, with coarse sand; massive; 10-30% angular quartz grit; pH 5.5-6.0.

Comments: The depth and degree of development of the B_2 horizon is variable.

MUNBURA (Mn)

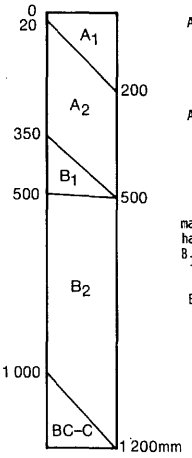
Concept: An acid, bleached red-yellow, massive, sandy duplex to gradational soil developed on coarse grained acid tuffs and intrusives.

Principal Profile Form: Dr 4.81; Dy 5.81; Gn 2.111, 2.14, 2.54.

Great Soil Group: Red-yellow podzolic soil.

Parent Material: Rhyodacitic crystal tuffs of Carmila Beds and acid intrusives.

Landform: Gently undulating plains to undulating rises, modal slopes 2-4%.



A_1: Greyish yellow brown; brownish grey (dry); loamy coarse sand to light sandy clay loam; 30-50% coarse quartz grit; massive; loose to weak hardsetting; pH 5.5-6.0. Clear to -

A_2: Light brownish grey to dull yellowish brown; light grey to dull yellow orange (dry); coarse sand to coarse sandy loam; commonly conspicuous bleach; massive; 40-60% coarse quartz grit; pH 5.5-6.0. Clear or gradual to -

may have B_1: Dull yellow orange to bright reddish brown; coarse sandy clay loam to sandy clay; massive; 40-50% quartz grit; pH 5.5.

B_2: Red, reddish brown to bright yellowish brown; whole coloured or may have 20% medium prominent red or yellow mottles; sandy clay to medium clay; massive; 15-50% quartz grit; pH 5.0-6.0.

DUNWOLD (Du)

Concept: An acid, bleached mottled yellow-grey sandy duplex soil developed on granite of the Urannah Igneous Complex.

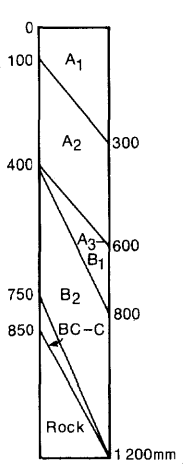
Principal Profile Form: Dy 5.41, 5.42, 3.41; Dg 4.41, 4.42; Dy 5.81, 5.82.

Great Soil Group: Yellow-gleyed podzolic soil.

Parent Material: Granite of the Urannah Igneous Complex.

Landform: Undulating plains to undulating rises; modal slopes 3-9% but may range to 15%.

Surface Features: May have 1-3% subangular gravel and cobble.



A_1: Greyish yellow brown to brownish grey; brownish grey to greyish yellow brown (dry); loamy coarse sand to light sandy clay loam, coarse sandy; may have sporadic bleach; massive; loose to weak hardsetting surface condition; pH 5.5-6.5. Clear or abrupt to -

A_2: Brownish grey, greyish yellow brown to dull yellow orange; light grey (dry); coarse sand to light sandy clay loam, coarse sandy; conspicuous bleach; massive; pH 5.5-6.5. Clear to -

may have A_3-B_1: Dull yellow orange to greyish yellow brown; may have 10-20% medium faint to distinct yellow, brown mottles; sandy clay loam, coarse sandy to coarse sandy clay; massive; may have 5% iron-manganese nodules; pH 5.5-6.5. Clear to abrupt to -

B_2: Light grey to greyish yellow and dull yellow orange to bright yellowish brown; 10-30% fine to medium distinct brown, red, yellow and grey mottles; coarse sandy clay to medium heavy clay with coarse sand; massive to moderate fine subangular blocky; may have 10% iron-manganese nodules; pH 5.5-6.5 (occasionally 7.0).

BC-C: Decomposing granite. Fresh rock may be encountered from 850 mm.

Comments: Alkaline pH in the B horizon of some profiles along the Gargett-Septimus fault line is probably due to influence from nearby Lizzie Creek volcanics.

Structure of the B horizon may vary from massive to moderate blocky over short distances.

SEPTIMUS (Sp)

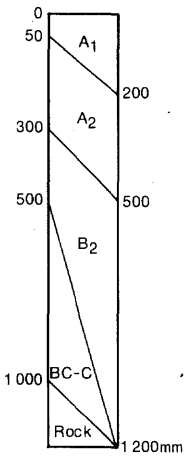
Concept: An acid, bleached sand with pale yellow B horizon developed on granite of the Urannah Igneous Complex.

Principal Profile Form: Uc 2.21, 2.22.

Great Soil Group: Rudimentary podzol.

Parent Material: Granite, mainly of the Urannah Igneous Complex.

Landform: Undulating rises; modal slopes 2-4% ranging to 8-12%.



A_1: Greyish yellow brown to brownish grey; brownish grey (dry); loamy sand, loamy coarse sand to coarse sandy loam; loose; massive; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown to brownish grey; light grey (dry); sandy loam, coarse sand to coarse sandy loam; massive; conspicuous bleach; 5-15% angular quartz and feldspathic grit; pH 5.8-6.0. Clear or gradual to -

B_2: Dull yellow orange to bright yellowish brown; may have 20% medium distinct grey mottles; gritty coarse sand to coarse sandy loam; massive; 15-50% angular quartz and feldspathic grit; may have 2-5% iron manganese nodules; pH 5.5-5.8. Diffuse to -

BC-C: Bright yellowish brown; mottled; decomposing granite; pH 5.5-6.5.

Comments: Occasionally the upper 10 cm of the B horizon has a coarse sandy clay loam texture, thus these Gn 2.34 profiles are bleached yellow earths.

Appendix IV (Continued)

URUBA, sandy A horizon variant (Ub 2)

Concept: An acid, bleached yellow sandy duplex to gradational soil developed on granite of the Urannah Igneous Complex.

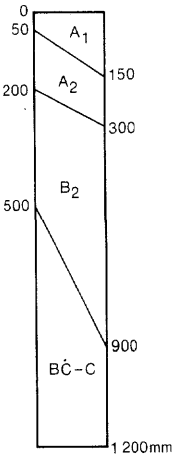
Principal Profile Form: Dy 2.82, 2.61, 3.82; Gn 2.65.

Great Soil Group: No suitable group.

Parent Material: Acid intrusives (granite to granodiorite) of the Urannah Igneous Complex.

Landform: Undulating to rolling rises; modal slopes 6-8% ranging to 16%.

Surface Features: Some rock outcrop.



A_1: Greyish yellow brown; brownish grey (dry); sandy loam, coarse sandy loam to light sandy clay loam; weak hardsetting; 2-15 angular quartz grit; massive; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown to dull yellowish brown; sandy clay loam to coarse sandy clay loam; may have conspicuous bleach; 2-15% angular quartz grit; massive; pH 5.8-6.0. Clear to -

B_2: Dull yellow orange to bright yellowish brown; may have 5-15% fine distinct grey and yellow mottles; sandy clay to medium clay sandy; 15-50% angular quartz grit; massive to weak structure; pH 5.8-6.0.

BC-C: Decomposing granite/granodiorite; light grey to dull yellow orange; coarse sandy clay loam to coarse sand; pH 6.0-7.0.

GARGETT, deep A horizon variant (Ga 1)

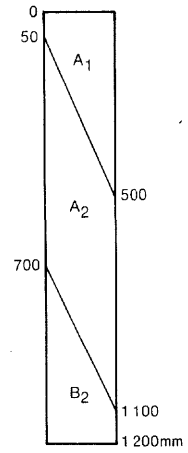
Concept: An acid, gleyed duplex soil with deep bleached sandy A horizon developed on alluvial-colluvial material from acid intrusives of Urannah Igneous Complex.

Principal Profile Form: Dy 5.81; Dg 4.81.

Great Soil Group: Gleyed podzolic soil.

Parent Material: Alluvial-colluvial materials from acid intrusives (granite) of Urannah Igneous Complex.

Landform: Gently undulating plains and rises; modal slopes 1-4%.



A_1: Brownish grey to greyish yellow brown; brownish grey (dry); loamy coarse sand to coarse sandy loam; massive; loose; pH 5.5-6.0. Abrupt or clear to -

A_2: Yellowish grey to brownish grey, greyish brown and dull yellow orange; light grey (dry); may have 10% fine distinct brown mottles; coarse sand to light sandy clay loam, coarse sandy; conspicuous bleach; massive; 20-40% quartz grit; may have 1-2% iron-manganese nodules; pH 5.5-6.0. Clear to -

B_2: Light grey to dull yellow and dull yellow orange to bright yellowish brown; 10-40% fine to medium distinct yellow, grey or brown mottles; coarse sandy clay to medium clay, with coarse sand; massive; 15-50% quartz grit; may have 10% iron-manganese nodules; pH 5.5-6.5.

GARGETT (Ga)

Concept: A neutral, bleached mottled yellow-grey sandy duplex soil developed on alluvial-colluvial material from acid intrusives of the Urannah Igneous Complex.

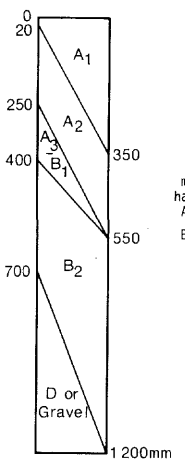
Principal Profile Form: Dy 3.42, 3.82, 5.42, 5.82, 3.41; Dg 4.82, 2.42.

Great Soil Group: Yellow-gleyed podzolic soil.

Parent Material: Alluvial-colluvial material from acid intrusives (granites) of the Urannah Igneous Complex.

Landform: Gently undulating to undulating plains and rises; modal slopes 1-3% but ranging to 6%.

Surface Features: May have 2% subangular cobble and gravel.



A_1: Greyish brown to greyish yellow brown; brownish grey (dry); coarse sandy loam to sandy clay loam; may have sporadic bleach; massive; loose to hardsetting; pH 5.5-6.0. Clear to abrupt to -

A_2: Brownish grey to greyish yellow brown and dull yellow orange; light grey (dry); coarse sandy loam to sandy clay loam; conspicuous bleach; massive; pH 5.5-6.0. Clear to abrupt to -

may have A_3-B_1: Greyish yellow brown to dull yellow orange; sandy clay loam to coarse sandy clay; massive to weak structure; may have 5% subangular gravel; 5% quartz grit; may have 10% iron-manganese nodules; pH 5.5-7.0. Clear to abrupt to -

B_2: Brownish grey to light grey and dull yellow orange to yellowish brown; 10-40% fine to medium distinct brown, yellow and grey mottles; sandy clay to medium heavy clay, medium to coarse sand evident; weak to moderate structure; may have 5% angular and subangular gravels; 5-15% quartz grit; may have 5-10% iron-manganese nodules; pH 6.0-7.5.

D: Buried layers of variable textures and colours.

Comments: Alkaline pH in the B horizon of some profiles along the Gargett-Septimus fault line is probably due to influence from the Lizzie Creek Volcanics.

TANNALO (Ta)

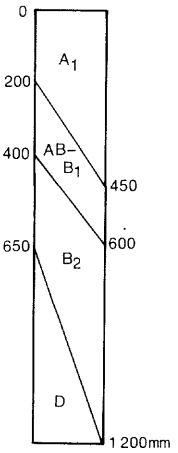
Concept: An acid to neutral brown massive sandy gradational soil developed on alluvial-colluvial material from the Urannah Igneous Complex.

Principal Profile Form: Gn 2.21, 2.22, 2.41, 2.42; Db 1.51.

Great Soil Group: No suitable group.

Parent Material: Alluvial-colluvial material from acid to intermediate intrusives (granite to granodiorite) of the Urannah Igneous Complex.

Landform: Gently undulating to undulating plains; modal slopes 2-4% ranging to 6%.



A_1: Dark brown to brownish black; brownish grey to greyish brown (dry); light sandy clay loam, coarse sandy clay loam to coarse sandy loam; massive; hardsetting; may have 10% granitic gravel; pH 5.5-6.0. Clear or gradual to -

AB or B_1: Brown, dull reddish brown and brownish black; sandy clay loam to coarse sandy clay; massive; may have 10% granitic gravel; pH 5.5-6.0. Clear or gradual to -

B_2: Dull brown, bright brown to brown; sandy clay, medium clay to coarse sandy clay loam; massive; may have 20% quartz grit; may have 10% gravel; pH 5.8-7.0. Clear to -

D: Dull reddish brown to brown; sandy loam, coarse sandy loam to sandy clay; may have 50-70% gravel; pH 5.8-7.0.

Comments: Some associated profiles are brown with uniform textures; Um 5.52.

Appendix IV (Continued)

FINCH HATTON (Fn)

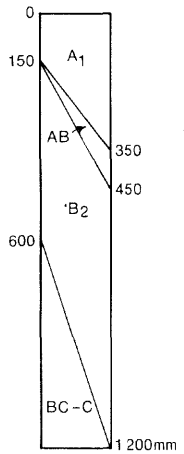
Concept: A neutral, red-brown non-cracking clay to gradational soil developed on granodiorite - diorite mainly of the Urannah Igneous Complex.

Principal Profile Form: Uf 6.31, 6.34; Gn 3.71.

Great Soil Group: No suitable group.

Parent Material: Granodiorite - diorite of Urannah Igneous Complex and Mt Jukes Syenite Complex.

Landform: Undulating to rolling rises; modal slopes 6-10% ranging from 4-18%.



A_1: Black to brownish black; brownish grey (dry); clay loam to light clay, may have fine sand or sand; moderate medium granular; hardsetting; pH 5.8-6.0. Clear to -

may have AB: Brown and brownish black; light clay to light medium clay; pH 5.8-6.5. Clear or gradual to -

B_2: Brown, bright brown to reddish brown; whole coloured but may have 10-15% fine distinct yellow or grey mottles at depth; medium clay to medium heavy clay; moderate to strong coarse subangular blocky breaking to fine subangular blocky; may have 5% nodules or soft segregations of iron-manganese; pH 6.0-7.0. Gradual to -

BC-C: Dull yellowish brown; light medium clay, with sand to sandy clay loam; weak, very coarse subangular blocky to massive; pH 6.0-7.0.

Comments: Weathered biotite is common in the B and C horizons. These soils intergrade with Netherdale and Uruba soils. Virgin profiles may have had clay loam surface textures but due to erosion and cultivation most now have clay surface textures.

NETHERDALE (Nt)

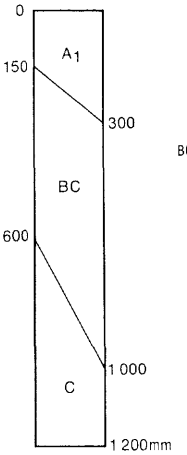
Concept: A grey-brown, structured, fine to medium textured A horizon directly overlying neutral decomposing granodiorite to syenite of the Urannah Igneous Complex.

Principal Profile Form: Uf 6; Um 5.

Great Soil Group: No suitable group.

Parent Material: Granodiorite of the Urannah Igneous Complex.

Landform: Undulating to rolling rises; modal slopes 6-10% ranging to 20%.



A_1: Dull yellowish brown, brown to greyish yellow brown; greyish yellow brown to dull brown (dry); light clay, light medium clay, to clay loam; hardsetting; moderate fine subangular blocky; pH 5.8-6.0. Clear or gradual to -

BC-C: Decomposing parent material; medium clay to light clay decreasing clay content with depth; pH 6.5-7.0.

Comments: Intergrade profiles to Finch Hatton or Uruba soils are due to surface texture and degree of B horizon development.

PINNACLE (Pc)

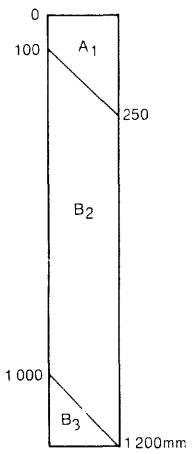
Concept: An acid, red, non-cracking clay developed on basic dyke rocks of the Urannah Igneous Complex.

Principal Profile Form: Uf 6.31.

Great Soil Group: Krasnozem.

Parent Material: Probably basic fine grained material from dykes of the Urannah Igneous Complex.

Landform: Undulating rises; modal slope 4-6%.



A_1: Reddish black to dark reddish brown; dull reddish brown (dry); light clay; hardsetting; moderate fine granular; pH 5.8-6.0. Gradual to -

B_2: Reddish brown to dark reddish brown; light medium clay to light clay; moderate medium subangular blocky breaking to strong very fine subangular blocky; may have 5% iron-manganese nodules; pH 5.5-6.0. Diffuse to -

B_3: Reddish brown; clay loam to light clay; pH 5.0-5.5.

Comments: B_2 horizons of bright yellowish brown may occur.

URUBA (Ub)

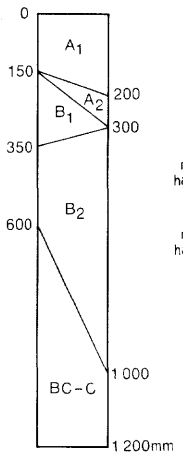
Concept: A neutral yellow-brown duplex soil developed on granodiorite of the Urannah Igneous Complex.

Principal Profile Form: Dy 2.12, 2.52, 2.11, 3.32; Dr 2.11.

Great Soil Group: Non-calcic brown to red-yellow podzolic soil.

Parent Material: Granodiorite of the Urannah Igneous Complex.

Landform: Undulating to rolling rises; modal slopes 4-8% ranging from 2-15%.



A_1: Brownish black to greyish yellow brown; brownish grey to greyish yellow brown (dry); sandy clay loam occasionally light sandy clay loam; may have 2-10% angular gravel; hardsetting; weak fine subangular blocky; pH 5.8-6.0. Clear to -

may have A_2: Brownish grey to dull yellowish brown, brownish grey (dry); sandy clay loam; sporadic bleach; massive; pH 5.8-6.0. Abrupt or clear to -

may have B_1: Dull yellow orange to dull yellowish brown; sandy clay; massive to weak structure; pH 5.8-6.0. Abrupt or clear to -

B_2: Bright yellowish brown, yellowish brown, dull yellow orange to reddish brown; may have 10-25% fine or medium, distinct grey mottles at depth; light medium clay to medium heavy clay; may have 2-10% quartz grit; weak coarse angular blocky or moderate medium prismatic breaking to moderate medium subangular blocky; may have 1-2% iron-manganese nodules. pH 6.0-7.0. Gradual or diffuse to -

BC-C: Dull yellowish brown to bright yellowish brown; light medium clay to medium clay decreasing to sandy clay and sandy clay loam with depth; pH 6.2-7.5.

Comments: B horizon structure and sporadic bleach development may vary over short distances.

Appendix IV (Continued)

FARLEIGH (F1)

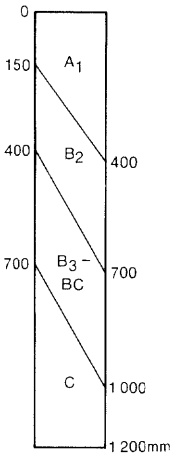
Concept: A shallow neutral yellow brown duplex soil with a dark A horizon developed on Wundaru granodiorite.

Principal Profile Form: Dy 2.12, 2.11, 5.12; Db 2.12.

Great Soil Group: No suitable group, affinities with non-calcic brown soil.

Parent Material: Wundaru granodiorite.

Landform: Undulating rises; modal slopes 4% ranging to 10%.



A_1: Brownish black to greyish brown; brownish grey to dull brown (dry); light sandy clay loam to sandy loam; weak fine granular; weak hardsetting to loose surface condition; pH 5.5-6.0. Abrupt or clear to -

B_2: Brown to dull yellowish brown; whole coloured or may have 10-20% medium distinct yellow mottles; medium clay to medium heavy clay with sand; moderate, very coarse angular blocky breaking to coarse angular blocky; pH 5.8-7.0. Gradual or diffuse to -

B_3-BC: Dull yellow orange to bright yellowish brown; 10-30% medium distinct pale yellow or grey mottles; sandy clay to light medium clay, with sand; weak very coarse angular blocky; pH 6.0-7.0.

C: Decomposing granodiorite; pH 6.0-7.0.

KOWARI (Kw)

Concept: An acid, black stony loam developed on alluvial-colluvial material from basic dyke rocks of the Urannah Igneous Complex.

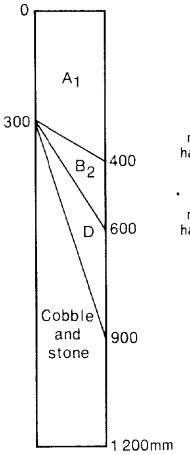
Principal Profile Form: Um 1.2; Um 5.5; Gn 2.01.

Great Soil Group: No suitable group.

Parent Material: Alluvial-colluvial material from basic dyke rocks of Urannah Igneous Complex.

Landform: Gently undulating to undulating rises; modal slopes 3-6% ranging to 10%.

Surface Features: 10-50% rounded cobble and stone from basic dykes.



A_1: Black; brownish grey (dry); fine gravelly loam to fine gravelly clay loam; massive to weak polyhedral; hardsetting; 2-10% subangular fine gravel; 10-50% rounded cobble and stone; pH 5.8-6.0. Clear to gradual to -

may have B_2: Black; clay loam to light clay; massive; 2-10% subangular fine gravel; 10-50% rounded cobble and stone; pH 6.0. Clear to -

may have D: Brown to dull yellowish brown; sandy clay loam to light clay; massive; pH 6.0-6.5.

FINCH HATTON, alluvial-colluvial variant (Fn 1)

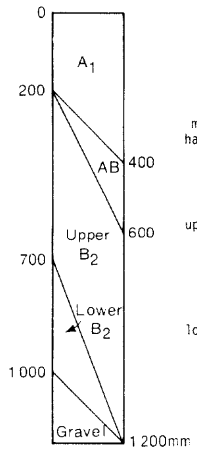
Concept: A neutral brown-yellow non-cracking clay to gradational soil developed on alluvial-colluvial material from intermediate intrusives (granodiorite) mainly of the Urannah Igneous Complex.

Principal Profile Form: Uf 6.34; Gn 3.51, 3.72.

Great Soil Group: No suitable group.

Parent Material: Alluvial-colluvial material from intermediate intrusives of Urannah Igneous Complex and Mt Jukes Syenite Complex.

Landform: Gently undulating to undulating rises; modal slopes 2-4% but ranging from 1-8%.



A_1: Brownish black; greyish brown (dry); sandy clay loam to light clay, with sand or fine sand; weak structure; hardsetting; pH 5.8-6.0. Clear to gradual to -

may have AB: Either whole coloured black, or brown and brownish black; light clay; weak to moderate structure; pH 5.8-6.0. Clear to gradual to -

B_2 upper: Brown to bright brown; may have 2-10% fine distinct yellow mottles; medium clay to medium heavy clay; moderate to strong structure; may have 2-10% feldspathic grit; pH 6.0-7.0. Gradual to -

B_2 lower: Brown to bright yellowish brown; 10-20% medium distinct yellow and grey mottles; light medium clay to medium heavy clay; moderate to strong structure; may have 1-5% iron-manganese nodules and soft segregations; may have 2-10% feldspathic grit; pH 6.0-7.5.

URUBA, alluvial-colluvial variant (Ub 1)

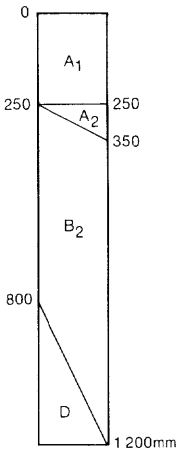
Concept: A neutral, mottled yellow duplex soil developed on alluvial-colluvial material from intermediate intrusives of the Urannah Igneous Complex.

Principal Profile Form: Dy 3.32, 3.12, 3.51.

Great Soil Group: No suitable group to yellow podzolic soil.

Parent Material: Alluvial-colluvial material from intermediate intrusives (granodiorite) of the Urannah Igneous Complex.

Landform: Undulating plains to undulating rises; modal slopes 2-4%.



A_1: Brownish black to brownish grey; brownish grey (dry); sandy clay loam; hardsetting; massive to weak structure; pH 5.8-6.0. Clear to -

may have A_2: Brownish grey; brownish grey (dry); sandy clay loam; sporadic bleach; massive; pH 5.8-6.0. Abrupt or clear to -

B_2: Dull yellowish brown to dull yellow orange; 10-20% medium distinct yellow or grey mottles increasing with depth; light medium clay to medium clay; may have 10% quartz and feldspathic grit; weak to moderate structure; may have 1-5% iron-manganese nodules; pH 6.0-7.0.

may have D: Yellowish brown to dull yellow orange; light clay, sandy clay loam or sand.

Appendix IV (Continued)

WAGOORA (Wg)

Concept: A neutral, brown-yellow gradational soil to non-cracking clay developed on intermediate volcanics mainly of the Carmila Beds, Lizzie Creek Volcanics and Calen Coal Measures.

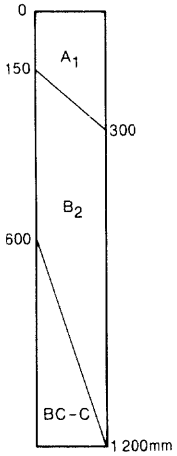
Principal Profile Form: Gn 3.22, 3.51, 3.72; Uf 6.34; Uf 6.4.

Great Soil Group: Prairie soil.

Parent Material: Intermediate volcanics (dykes and sills) of the Carmila Beds, Lizzie Creek Volcanics and Calen Coal Measures.

Landform: Undulating rises; modal slopes 3-6% ranging 2-10%.

Surface Features: May have 10-20% volcanic cobble and stone and some rock outcrop.



A_1: Brownish black; brownish grey, greyish brown to dull brown (dry); clay loam, fine sandy clay loam to light clay; hardsetting; weak to moderate medium granular; pH 5.8-6.0. Gradual to clear to -

B_2: Dull yellowish brown, bright brown to brown; whole coloured or may have 20% fine to medium distinct red, yellow or grey mottles; medium clay to medium heavy clay; moderate, fine to medium subangular blocky; 2-5% iron-manganese nodules; pH 6.0-8.0. Gradual to diffuse to -

BC-C: Bright yellowish brown to greyish yellow brown; 5-20% fine, distinct grey, yellow and pale mottles; sandy clay loam to light clay; pH 6.0-8.0.

WAGOORA, basic parent material variant (Wg 1)

Concept: A neutral brown-red non-cracking clay to gradational soil developed on basic to intermediate volcanics of the Campwyn Beds.

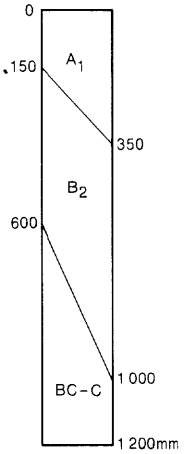
Principal Profile Form: Gn 3.51, 3.72, 3.11; Uf 6.31.

Great Soil Group: Prairie soil.

Parent Material: Basic to intermediate volcanics of the Campwyn Beds.

Landform: Undulating plains to undulating rises modal slopes 2-4% ranging 1-10%.

Surface Features: May have 10-20% rounded volcanic cobble and some rock outcrop.



A_1: Brownish black; greyish brown to dull brown (dry); clay loam to light clay; hardsetting to weak self-mulch; 1-5% iron-manganese nodules; moderate medium granular; pH 5.8-6.0. Gradual to clear to -

B_2: Dull reddish brown, brown to bright brown; may have 20% fine distinct red or yellow mottles; light medium clay to medium heavy clay; strong fine subangular blocky; may have 5-10% volcanic gravel; 5-15% iron-manganese nodules; pH 6.0-7.0. Gradual to -

BC-C: Dark reddish grey to bright yellowish brown; 15-30% medium distinct grey or yellow mottles; light clay; pH 6.0-7.0.

NABILLA (Na)

Concept: A neutral, brown gradational soil with abundant iron-manganese nodules developed on altered intermediate volcanics of the Carmila Beds.

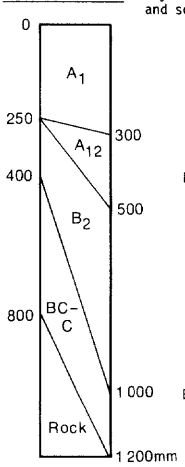
Principal Profile Form: Gn 3.52, 3.72, 3.92; Dy 3.12.

Great Soil Group: Prairie soil.

Parent Material: Altered intermediate volcanics of Carmila Beds.

Landform: Undulating rises; modal slopes 2-6% ranging to 8-10%.

Surface Features: May have 5-15% rounded volcanic gravel and cobble and some rock outcrop.



A_1: Brownish black; brownish grey to dull brown (dry); clay loam to fine sandy clay loam; hardsetting; weak to moderate fine subangular blocky; 5-15% iron-manganese nodules; pH 5.8-6.0. Clear to gradual to -

A_{12}: may have Brownish black; clay loam to light clay; moderate fine subangular blocky; 10-30% iron-manganese nodules; 5-10% iron-stained fine gravel; pH 5.8-6.0. Clear to gradual to -

B_2: Dull yellowish brown, brown to light brown; may have 15% fine to medium distinct red or yellow mottles; medium clay to medium heavy clay; moderate to strong fine to medium subangular blocky; 5-15% iron-manganese nodules; may have 5-15% volcanic gravel; pH 6.5-7.5. Gradual to -

BC-C: Yellow and grey mottled; sandy clay loam to medium clay; pH 6.5-8.0.

Comments: A shallow Gn 3.41 occurs with the Nabilla soils. An associated profile on minor colluvium has a sporadically bleached A_2 horizon with over 50% iron-manganese nodules.

ROYSTON (Ro)

Concept: A neutral, dark, self-mulching non-cracking clay developed on intermediate volcanics of the Lizzie Creek Volcanics.

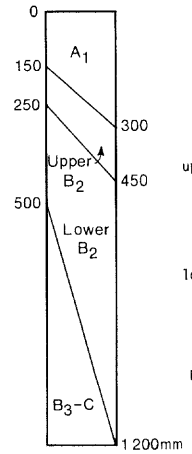
Principal Profile Form: Uf 6.32.

Great Soil Group: Prairie soil.

Parent Material: Intermediate volcanics (andesite) of the Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 4-8% ranging from 2-12%.

Surface Features: May have 5-10% rounded intermediate volcanic cobble and some rock outcrop.



A_1: Black; brownish grey (dry); light clay to light medium clay; weakly to moderately self-mulching; weak fine to medium subangular blocky; may have 5% subangular gravel; pH 5.8-6.0. Clear to gradual to -

B_2 upper: Black, may have 5% fine distinct brown mottles; light medium to medium heavy clay; strong medium to coarse subangular blocky; may have 2% iron-manganese nodules; pH 5.8-6.0. Clear to gradual to -

B_2 lower: Dull yellowish brown, brown and greyish yellow brown; may have 10% fine distinct yellow mottles; medium heavy clay to heavy clay; moderate to strong coarse angular blocky; may have 5% iron-manganese nodules; pH 6.0-7.0. Clear to gradual to -

B_3-C: Brown; light clay; pH 6.0-8.0.

Comments: Occasionally the black A_1 horizon overlies the brownish lower B_2 horizon.

Appendix IV (Continued)

MARTIN (Mr)

Concept: A neutral, cobbly, yellow-brown duplex to gradational soil developed on intermediate volcanics of the Lizzie Creek Volcanics.

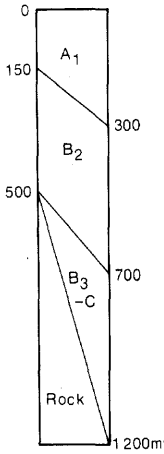
Principal Profile Form: Gn 3.51, 3.72; Dy 2.11, 3.12.

Great Soil Group: Minimal prairie soil.

Parent Material: Intermediate medium grained volcanics of Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 4-8% ranging to 15%.

Surface Features: May have 5-25% subangular volcanic cobble and gravel.



A_1: Brownish black to greyish yellow brown; greyish brown to greyish yellow brown (dry); fine sandy clay loam and clay loam, occasionally clay loam, sandy; weak to moderate fine subangular blocky; hardsetting; may have 1-10% subangular gravel and cobble; pH 5.8-6.0. Clear to gradual to -

B_2: Dull yellowish brown to greyish yellow brown; whole coloured or may have 10-20% fine distinct yellow or brown mottles; medium clay; strong coarse angular blocky; may have 5% iron-manganese nodules; pH 6.0-7.0. Gradual to diffuse to -

B_3-C: Light clay to sandy clay loam; massive to weak structure; pH 6.0-8.0; lime nodules may occur deep in the C horizon.

KUNGURRI (Kn)

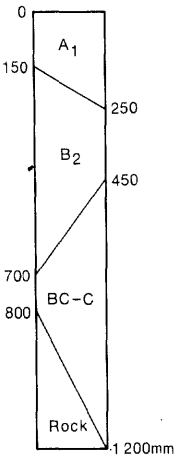
Concept: An acid, reddish brown gradational soil to non-cracking clay developed on intermediate volcanics of the Lizzie Creek Volcanics.

Principal Profile Form: Gn 3.21, 3.51, 3.71; Uf 6.31.

Great Soil Group: No suitable group.

Parent Material: Intermediate to basic volcanics (perhaps altered) of Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 4-8%



A_1: Brown to dull reddish brown; dull brown (dry); clay loam to light clay; moderate medium granular; hardsetting to weak self-mulch; pH 5.8-6.0. Clear to gradual to -

B_2: Yellowish brown, brown to reddish brown; may have 20% fine distinct red, yellow or grey mottles; light medium clay to medium heavy clay; strong fine subangular blocky; may have 1-2% iron-manganese nodules; pH 5.5-6.0. Gradual to diffuse to -

BC-C: Bright yellowish brown and light grey; may have 25% coarse prominent red to purple mottles; light clay; strong very fine subangular blocky; pH 5.0-5.5.

GLENELLA (Gl)

Concept: A neutral, brown gradational soil to non-cracking clay developed on intermediate Cretaceous dyke rocks.

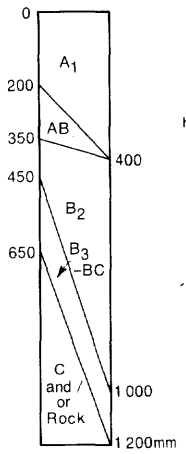
Principal Profile Form: Gn 3.21, 3.22, 3.71, 3.72; Uf 6.31, 6.34; Db 1.12.

Great Soil Group: Prairie soil.

Parent Material: Cretaceous intermediate to basic dyke rocks (microdiorite).

Landform: Undulating rises and undulating plains; modal slopes 3-8% ranging to 12%.

Surface Features: 2-25% subangular to rounded cobble and stone on surface and some rock bars.



A_1: Brownish black to black; brownish grey to greyish yellow brown (dry); clay loam, fine sandy clay loam to light clay; moderate very fine subangular blocky; hardsetting; may have 15% subangular gravel and cobble; pH 5.8-6.0. Gradual to -

may have AB: Brownish black to black; light clay to medium clay; moderate medium angular blocky breaking to moderate very fine subangular blocky; may have 15% subangular gravel; may have 10% iron-manganese nodules; pH 5.8-6.0. Clear to gradual to -

B_2: Brown to bright brown and dull yellowish brown; 5-15% fine distinct yellow red or grey mottles; light medium clay to medium heavy clay; moderate to strong coarse angular blocky breaking to strong fine subangular blocky; may have 10% subangular gravel; may have 10% iron-manganese nodules; pH 5.8-7.0. Clear to gradual to -

B_3-BC: Dull to bright yellowish brown or dark greyish yellow to grey; 10-30% fine to medium distinct grey or yellow mottles; light clay to medium clay; weak to moderate coarse subangular blocky; may have 5% iron-manganese nodules; pH 6.0-7.0. Clear to gradual to -

C: Sandy clay loam to light clay; pH 6.0-7.0.

Comments: The Glenella soil intergrades with the Habana soil.

HABANA (Hb)

Concept: An acid, cobbly yellow-brown gradational soil developed on intermediate to acid volcanics and tuffs of Carmila Beds and possibly Campwyn Beds.

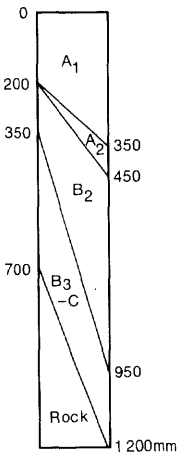
Principal Profile Form: Gn 3.71, 3.72; Uf 6.34; Dy 3.11, 3.31.

Great Soil Group: No suitable group.

Parent Material: Intermediate to acid volcanics and tuffs of Carmila Beds and possibly Campwyn Beds.

Landform: Undulating rises and rolling rises; modal slopes 3-8% but ranging to 18%.

Surface Features: 10-25% angular volcanic and tuffaceous gravel and cobble.



A_1: Brownish black to greyish brown; greyish yellow brown (dry); sandy clay loam to light clay with sand; weak to moderate medium granular; hardsetting; 10-25% angular to subangular gravel and cobble; pH 5.8-6.0. Clear to gradual to -

may have A_2: Similar to A_1 but with sporadic bleach. Clear to gradual to -

B_2: Dull yellowish brown to bright brown; may have 5-20% fine to medium distinct yellow brown or red mottles; light medium clay to medium clay; moderate medium to coarse subangular blocky breaking to moderate fine subangular blocky; 1-5% iron-manganese nodules; pH 5.8-7.0. Gradual to diffuse to -

B_3-C: Dull to bright yellowish brown; 10-40% medium distinct brown yellow and grey mottles; sandy clay loam to sandy clay; massive to weak structure; may have 2% iron-manganese nodules; pH 6.0-7.0.

Comments: The Habana soil intergrades with the Glenella soil.

Appendix IV (Continued)

SILENT GROVE (Sg)

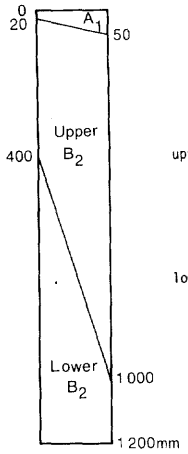
Concept: An alkaline, black, self-mulching, cracking clay developed on alluvial-colluvial material from basic to intermediate volcanics of Carmila Beds and Lizzie Creek Volcanics.

Principal Profile Form: Ug 5.15, 5.16.

Great Soil Group: Black earth.

Parent Material: Alluvial-colluvial material from basic to intermediate volcanics of Carmila Beds and Lizzie Creek Volcanics.

Landform: Undulating plains to undulating rises; modal slopes 2-6%.



A_1: Brownish black to black; brownish black to brownish grey (dry); light clay to medium clay; self-mulching; cracking; strong fine to medium granular; pH 5.8-6.0. Gradual to -

B_2 upper: Brownish black to black; may have 5-15% fine distinct brown mottles; light medium to medium heavy clay; strong structure; may have 10% subangular gravel; may have 5% iron-manganese nodules; pH 6.5-8.0. Clear to gradual to -

B_2 lower: Olive, brownish grey to dull yellow brown; 5-40% medium distinct brown, yellow and grey mottles; medium heavy to heavy clay; strong structure; may have 15% subangular gravel; may have 10% iron-manganese nodules; 5-15% carbonate nodules; pH 8.0-9.0.

Comments: In some profiles in upper slope positions decomposing rock may be encountered; Ug 5.13. These profiles are most likely intergrades with the Wagoora or Royston soils.

ETOWRIE, neutral duplex variant (Et 1)

Concept: A neutral, bleached yellow duplex soil developed on alluvial-colluvial material from Campwyn Beds.

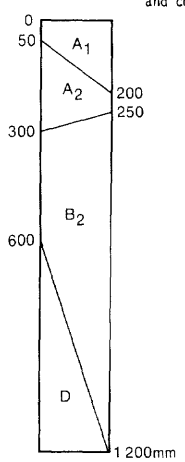
Principal Profile Form: Dy 2.32, 2.42.

Great Soil Group: Soloth to yellow podzolic soil.

Parent Material: Alluvial-colluvial material from intermediate volcanics of Campwyn Beds.

Landform: Alluvial-colluvial flats to gently undulating plains; modal slopes 1-3%.

Surface Features: May have 5% angular to subangular volcanic gravel and cobble.



A_1: Greyish brown to greyish yellow brown; brownish grey (dry); fine sandy clay loam; weak structure; hardsetting; pH 5.8-6.0. Clear to -

A_2: Greyish brown; brownish grey to light grey (dry); fine sandy clay loam; sporadic to conspicuous bleach; weak structure. Abrupt or clear to -

B_2: Dull yellowish brown to dull yellow orange; whole coloured but may have 10% fine distinct grey and yellow mottles; light medium clay to medium clay; moderate structure; 2-15% angular to subangular volcanic gravel; 2-5% iron-manganese nodules; pH 6.0-7.0.

may have D: Buried layers of clay and gravel.

ETOWRIE (Et)

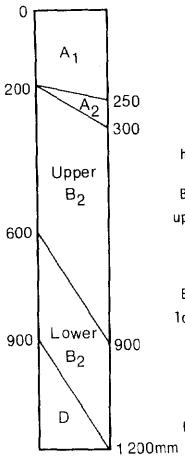
Concept: An alkaline, grey non-cracking clay to duplex soil developed on alluvial-colluvial material from intermediate to basic volcanics of Carmila Beds, Cretaceous dykes and Lizzie Creek Volcanics.

Principal Profile Form: Uf 6.41; Dy 3.33.

Great Soil Group: No suitable group and solodic - solodized solonetz soil.

Parent Material: Alluvial-colluvial material from intermediate to basic volcanics of Carmila Beds and Lizzie Creek Volcanics.

Landform: Alluvial-colluvial flats and undulating plains; modal slopes 2-4% ranging from 1-6%.



A_1: Brownish black to brownish grey; brownish grey to greyish yellow brown (dry); may have 10% fine distinct rootline mottles; light medium clay to fine sandy clay loam; weak to moderate structure; hardsetting to weak self-mulch; may have 5% subrounded volcanic gravel; pH 5.8-6.0. Clear to -

may have A_2: Is similar to A_1 but with sporadic bleach.

B_2.. upper: Yellowish grey to dull yellowish brown; 10-30% fine to medium distinct grey, yellow or brown mottles; medium clay to heavy clay; strong structure; may have 5% iron-manganese nodules; pH 6.5-7.5. Gradual to diffuse to -

B_2.. lower: Brownish grey to dull yellow orange; 10-20% fine to medium distinct grey, yellow or brown mottles; medium clay to heavy clay; moderate to strong structure; may have 5% iron-manganese nodules, may have 10% soft and nodular carbonate; pH 8.5-9.0.

may have D: Buried layers of clay with varying colour and gravel content.

WHIPTAIL (Wh)

Concept: An acid, bleached, mottled, yellow duplex soil developed on acid to intermediate volcanics of the Carmila Beds and Lizzie Creek Volcanics.

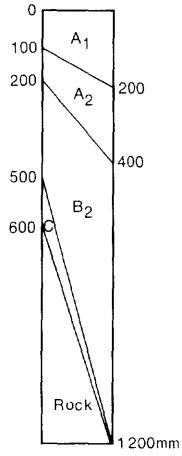
Principal Profile Form: Dy 3.41, 3.42, 2.41, 3.31.

Great Soil Group: Soloth.

Parent Material: Acid to intermediate volcanics of Lizzie Creek Volcanics and Carmila Beds.

Landform: Undulating rises; modal slopes 4-6% ranging 2-10%.

Surface Features: 2-30% acid to intermediate angular volcanic gravel and cobble and some rock bars.



A_1: Brownish grey to dark greyish yellow; brownish grey (dry); sandy clay loam, light sandy clay loam and fine sandy clay loam; hardsetting; massive; pH 5.8-6.0. Clear to -

A_2: Brownish grey to yellowish grey; light grey to brownish grey (dry); sandy clay loam, light sandy clay loam to fine sandy clay loam; conspicuous or sporadic bleach; massive; may have 2-20% weakly ferruginized angular gravel; pH 5.5-6.0. Abrupt to -

B_2: Dull yellow, bright yellowish brown to yellowish brown; may have 10-30% fine to medium distinct grey and red mottles; medium clay to heavy clay; weak to moderate coarse prismatic breaking to moderate medium to coarse angular blocky; may have 1-2% iron-manganese nodules; may have 5-20% angular gravel; pH 5.5-7.0. Gradual to -

C: Yellow to bright yellowish brown; pH 6.0-7.0.

Appendix IV (Continued)

WOLLINGFORD (Wo)

Concept: An alkaline, bleached, mottled grey-yellow duplex soil developed on acid to intermediate volcanics of the Carmila Beds, Lizzie Creek Volcanics and associated minor colluvium.

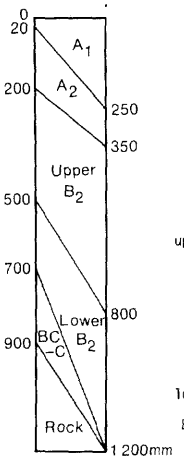
Principal Profile Form: Dy 2.43, 3.43, 2.33, 3.33, 3.42; Db 1.33.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Acid to intermediate volcanics and associated minor colluvium of Carmila Beds and Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 4-6% ranging from 2-10%.

Surface Features: May have angular volcanic gravel and cobble and some rock bars.



A_1: Brownish grey to brownish black; greyish yellow brown to brownish grey (dry); fine sandy clay loam, loam fine sandy to sandy clay loam; hardsetting; massive to weak medium granular; pH 5.8-6.0. Clear to -

A_2: Brownish grey; brownish grey to light grey (dry); fine sandy clay loam, loam fine sandy to sandy clay loam; conspicuous or sporadic bleach; massive; pH 5.8-6.0. Abrupt to -

B_2 upper: Dark greyish yellow, dull yellowish brown, light yellow to grey; whole coloured or 10-20% medium distinct grey, yellow or red mottles; medium clay to heavy clay; may have 1-5% iron-manganese nodules; moderate medium to coarse columnar or prismatic breaking to coarse angular blocky; pH 6.5-7.5. Gradual to -

B_2 lower: Similar to above with 5-15% carbonate nodules; pH 8.2-9.0.

BC-C: Light grey to yellowish brown; pH 8.0-9.0.

WOLLINGFORD, intrusive parent material variant (Wo 1)

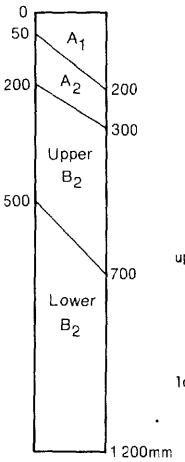
Concept: An alkaline, bleached, mottled yellow-olive duplex soil developed on acid to intermediate dyke material of the Urannah Igneous Complex.

Principal Profile Form: Dy 3.33, 3.43, 2.33, 2.43.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Acid to intermediate dyke materials of Urannah Igneous Complex.

Landform: Undulating plains to undulating rises; modal slopes 2-4%.



A_1: Greyish yellow brown to brownish grey; brownish grey (dry); fine sandy clay loam to sandy clay loam; hardsetting; massive; may have 2-10% angular gravel; pH 5.8-6.0. Clear to -

A_2: Brownish grey to greyish yellow brown; brownish grey to light grey (dry); fine sandy clay loam to sandy clay loam; sporadic or conspicuous bleach; massive; pH 5.8-6.0. Abrupt to -

B_2 upper: Yellowish brown, dull yellow to olive; 10-40% fine distinct yellow or grey mottles; medium clay to medium heavy clay; moderate structure; 5-15% feldspathic and quartz grit; 2-5% iron-manganese nodules; pH 6.0-7.5. Gradual to -

B_2 lower: Similar features to upper B with pH 8.2-9.0; may have 5-15% soft or nodular carbonate.

WOLLINGFORD, yellow B horizon variant (Wo 2)

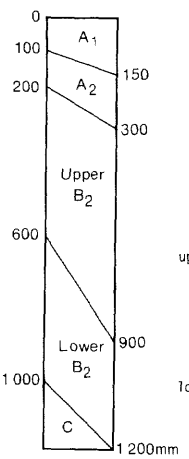
Concept: An alkaline, bleached yellow duplex soil developed on acid to intermediate tuffs and volcanics of the Campwyn Beds.

Principal Profile Form: Dy 2.43, 2.33, 3.43, 3.33.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Acid to intermediate tuffs and volcanics and associated minor colluvium from Campwyn Beds.

Landform: Gently undulating plains; modal slopes 1-3%.



A_1: Brownish grey to dull yellowish brown; brownish grey to dull yellow orange (dry); fine sandy clay loam to sandy clay loam; hardsetting; massive; pH 5.8-6.0. Clear to -

A_2: Brownish grey to dull yellowish brown; light grey to dull yellow orange (dry); fine sandy clay loam to sandy clay loam; sporadic or conspicuous bleach; may have 5-15% iron-manganese nodules; pH 5.8-6.0. Abrupt to -

B_2 upper: Bright yellowish brown to dull yellow orange; whole coloured or 5-25% fine to medium distinct grey or brown mottles; medium clay to medium heavy clay; moderate to strong structure; may have 1-10% ferruginized gravel; 2-5% iron-manganese nodules; pH 6.5-7.5; Gradual to -

B_2 lower: Greyish yellow brown to greyish yellow; 10-25% fine to medium distinct grey and brown mottles; medium clay to heavy clay; may have 2-15% ferruginized gravel; 2-10% soft or nodular carbonate; pH 8.5-9.0.

may have C: Bright yellowish brown; pH 8.5-9.0.

MENTMORE (Me)

Concept: An acid, bleached gravelly, mottled, yellow duplex soil developed on acid tuffs of Campwyn Beds.

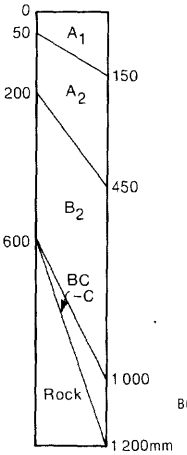
Principal Profile Form: Dy 3.41, 3.42, 2.41.

Great Soil Group: Soloth.

Parent Material: Acid tuffs of Campwyn Beds and possibly Carmila Beds.

Landform: Undulating rises; modal slopes 2-6%.

Surface Features: 5-30% angular to subangular gravel and cobble.



A_1: Greyish yellow brown; brownish grey (dry); light sandy clay loam to gravelly sandy clay loam, occasionally fine sandy clay loam; weak fine granular; hardsetting; 10-20% angular to subangular iron-stained gravel; pH 5.8-6.0. Clear to -

A_2: Dull yellow orange to greyish yellow brown; light grey (dry); gravelly sandy clay loam; weak fine granular; conspicuous bleach; 10-80% angular to subangular iron-stained gravel; pH 5.8-6.0. Abrupt to clear to -

B_2: Yellowish brown, bright yellowish brown to bright brown; 10-40% medium distinct pale, red or grey mottles; light medium clay to medium heavy clay; moderate medium angular blocky; 5-20% angular to subangular iron-stained gravel; 2-5% iron-manganese nodules; pH 5.5-7.0. Clear to -

BC-C: Greyish yellow to bright yellowish brown; sandy clay to light medium clay; massive to weak structure; pH 5.5-7.0.

Appendix IV (Continued)

MENTMORE, sandy loam variant (Me 1)

Concept: An acid, bleached yellow duplex soil with a shallow sandy loam A horizon and developed on acid tuffs of the Campwyn Beds.

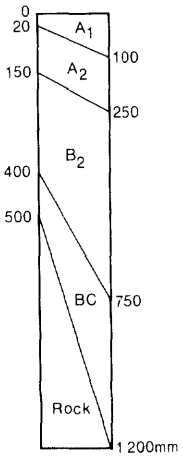
Principal Profile Form: Dy 3.41, 5.41.

Great Soil Group: Soloth.

Parent Material: Acid tuffs of Campwyn Beds.

Landform: Undulating rises and plains; modal slopes 2-4% but ranging to 6%.

Surface Features: May have 5-10% subangular cobble and gravel.



A_1: Brownish grey to greyish yellow brown; brownish grey (dry); sandy loam; massive; loose to weak hardsetting; may have 5% subangular gravel; pH 5.5-6.0. Clear to abrupt to -

A_2: Greyish yellow brown to brownish grey; light grey (dry); conspicuous bleach; sandy loam; massive; may have 10% subangular gravel; pH 5.5-6.0. Abrupt to -

B_2: Bright yellowish brown to dull yellow orange; 10-30% medium distinct red, grey and pale mottles; medium clay to medium heavy clay; moderate structure; may have 5% subangular gravel; pH 5.5-6.0. Clear to gradual to -

BC: Bright yellowish brown, pale yellow and light grey; 10-40% medium distinct yellow, red and grey mottles; sandy clay to light clay; massive to weak structure; may have 5% subangular gravel; pH 5.5-7.0.

BELMUNDA (Bl)

Concept: An acid, brown duplex soil with abundant iron-manganese nodules developed on epidotized intermediate volcanics of Campwyn Beds and associated minor colluvium.

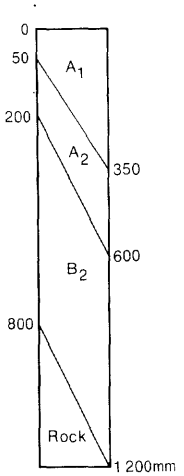
Principal Profile Form: Db 1.31, 2.32; Dy 2.32, 3.41.

Great Soil Group: No suitable group.

Parent Material: Epidotized intermediate volcanics of Campwyn Beds and associated minor colluvium.

Landform: Undulating rises and plains; modal slopes 2-6%.

Surface Features: May have 10% subangular volcanic cobble and stone and some rock bars.



A_1: Greyish brown to brownish black; greyish yellow brown to brownish grey (dry); sandy clay loam to clay loam, sandy; weak very fine subangular blocky; hardsetting; may have 5% subangular volcanic gravels; 10-30% iron-manganese nodules and fine subrounded iron-stained gravels; pH 5.8-6.0. Clear or gradual to -

A_2: Brownish grey to dull yellowish brown; light grey to dull yellow orange (dry); gravelly sandy loam to gravelly sandy clay loam; sporadic to conspicuous bleach; massive; 20-60% iron-manganese nodules and fine subrounded iron-stained gravels; pH 5.8-6.0. Clear to abrupt to -

B_2: Dull yellowish brown to bright brown; 5-30% fine to medium distinct grey, yellow or red mottles; gravelly sandy clay to gravelly medium heavy clay; moderate coarse subangular blocky breaking to moderate fine subangular blocky; 15-50% iron-manganese nodules and fine subrounded iron-stained gravels; pH 5.8-6.7.

Comments: A 150 - 200 mm thick A_3 or B_1 horizon may occur with dull yellow orange to dull yellowish brown gravelly sandy clay loam to gravelly sandy clay. Profiles developed on minor colluvium have the deeper A horizons and stronger bleach development.

PINDI (Pi)

Concept: An acid, bleached, mottled, yellow duplex soil with abundant iron-stained gravel and developed on sedimentary rocks of the Carmila Beds and Lizzie Creek Volcanics.

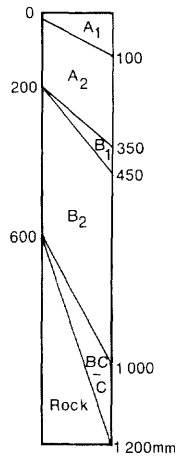
Principal Profile Form: Dy 3.41, 3.31, 3.32, 2.31.

Great Soil Group: Soloth.

Parent Material: Fine grained sedimentary rocks of Carmila Beds and Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 3-6% ranging from 2-8%.

Surface Features: May have 5-10% angular gravel and some rock bars.



A_1: Brownish grey to yellowish grey; brownish grey (dry); sandy clay loam, light sandy clay loam occasionally loam, fine sandy; hardsetting; 0-10% angular to subangular iron-stained gravel; massive; pH 5.8-6.0. Clear to -

A_2: Brownish grey to yellowish grey; brownish grey to light grey (dry); gravelly sandy clay loam, sandy clay loam occasionally loam, fine sandy; 10-70% angular to subrounded iron-stained gravel; sporadic to conspicuous bleach; massive; pH 5.8-6.0. Abrupt to -

may have B_1: Greyish yellow brown to dull yellowish brown; gravelly light clay to light medium clay; 30-50% iron-stained gravel. Clear to -

B_2: Dull yellowish brown to bright yellowish brown; may be whole coloured but usually 10-30% fine to medium, distinct yellow, red and grey mottles increasing with depth; medium clay, medium heavy clay occasionally medium clay gravelly; may have 10-20% iron-stained gravel; moderate medium prismatic breaking to moderate fine to medium angular blocky; may have 2% iron-manganese nodules; pH 5.8-6.5.

may have BC-C: Light yellow to bright yellowish brown; 10-30% medium distinct grey mottles; light clay to light medium clay; massive; pH 5.8-6.5.

JUMPER (Jm)

Concept: An alkaline, bleached, mottled, yellow-olive duplex soil with abundant iron-stained gravel developed on sedimentary rocks of the Carmila Beds and Lizzie Creek Volcanics.

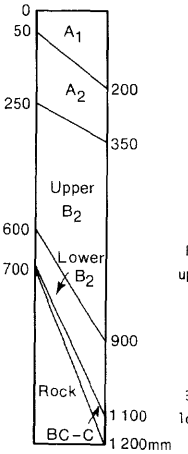
Principal Profile Form: Dy 3.33, 3.43, 2.33, 2.43.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Fine grained sedimentary rocks of Carmila Beds and Lizzie Creek Volcanics.

Landform: Undulating rises; modal slopes 3-6%.

Surface Features: 1-10% angular to subangular cobble (of fine grained sediments).



A_1: Brownish grey to greyish yellow brown; brownish grey to greyish yellow brown (dry); sandy clay loam to fine sandy clay loam; massive; hardsetting; may have 10% angular, subangular to rounded iron-stained gravel; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown to brownish grey; light grey to greyish yellow (dry); gravelly sandy clay loam to fine sandy clay loam; sporadic or conspicuous bleach; 10-70% angular, subangular to rounded iron-stained gravel; pH 5.8-6.0. Abrupt to clear to -

B_2.. upper: Dull yellowish brown to bright yellowish brown to olive yellow; whole coloured or 10-25% fine to medium faint to distinct red and grey mottles; medium clay to heavy clay; moderate coarse prismatic and columnar breaking to strong coarse blocky; may have 10% iron-stained gravel; 1-5% iron-manganese nodules; pH 6.0-7.5. Gradual to -

B_2.. lower: Similar to upper B_2 apart from increased mottling: may have carbonate, soft segregations or nodules; pH 8.5-9.5. Clear to -

may have BC-C: Bright yellowish brown; 10-25% fine distinct grey mottles; light clay to sandy clay loam; massive; pH 8.5-9.5.

Comments: Some profiles may have a 50 - 100 mm thick A_3-B_1 horizon with dull yellowish brown; gravelly heavy sandy clay loam to gravelly light clay with 10-50% iron-stained gravel.

Appendix IV (Continued)

PALMYRA (Pa)

Concept: An acid, bleached, gravelly, shallow, mottled, pale yellow duplex soil developed on sedimentary rocks of the Carmila Beds.

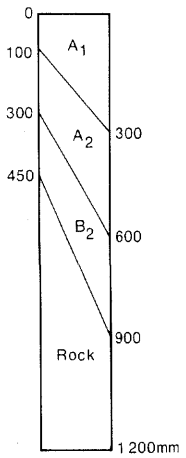
Principal Profile Form: Dy 3.41, 3.42.

Great Soil Group: Soloth.

Parent Material: Fine grained sedimentary rocks of Carmila Beds.

Landform: Undulating plains to undulating rises; modal slopes 2-4% ranging to 10%.

Surface Features: 5-20% angular gravel with rock bars.



A_1: Yellowish grey to brownish grey; brownish grey (dry); sandy clay loam to gravelly sandy clay loam occasionally loam, fine sandy; hardsetting; massive; 10-20% angular iron-stained gravel; may have a sporadic bleach; pH 5.8-6.0. Clear to -

A_2: Yellowish grey to brownish grey; light grey (dry); gravelly sandy clay loam to loam, fine sandy gravelly; conspicuous bleach; massive; 20-80% angular to subangular iron-stained gravel; pH 5.8-6.0. Clear to -

B_2: Dark greyish yellow, dull yellow to olive yellow; 5-30% medium distinct grey, yellow or brown mottles; medium clay, medium clay gravelly to gravelly light clay; 5-20% angular to subangular iron-stained gravel; moderate medium to coarse subangular blocky; may have 2% iron-manganese nodules; pH 5.8-6.0.

KUTTABUL (Ku)

Concept: An acid, bleached, yellow-red duplex soil developed on quartzose sandstone of the Calen Coal Measures and Lizzie Creek Volcanics.

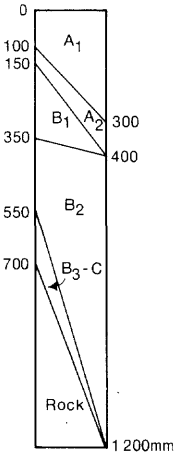
Principal Profile Form: Dy 2.21, 2.31, 2.41, 3.31, 3.41, 2.32.

Great Soil Group: Yellow-red podzolic soil.

Parent Material: Quartzose sandstone of Calen Coal Measures and Lizzie Creek Volcanics.

Landform: Undulating rises and plains; modal slopes 3-10%.

Surface Features: May have 5% sandstone cobble and stone.



A_1: Greyish yellow brown to brownish grey; greyish brown to greyish yellow brown (dry); sandy loam to sandy clay loam; weak fine subangular blocky; hardsetting; pH 5.5-6.0. Clear to abrupt to -

A_2: Dull yellowish brown to dull yellow orange; dull yellow orange to light brownish grey (dry); commonly sporadic or conspicuous bleach; loam, fine sandy to sandy clay loam; weak fine subangular blocky; pH 5.5-6.0. Clear to abrupt to -

may have B_1: Dull yellowish brown to bright yellowish brown and dull yellow orange; may have 20% fine to medium distinct grey mottles; sandy clay to light clay, with sand; weak medium subangular blocky; may have 5% sandstone gravel; may have 5% iron-manganese nodules; pH 5.5-6.0. Clear to gradual to -

B_2: Dull yellowish brown to bright yellowish brown, dull yellow orange to reddish brown; may have 30% fine to medium distinct and prominent brown, red and grey mottles; light medium clay to medium heavy clay; moderate to strong medium subangular blocky; may have 10% sandstone gravel; may have 10% iron-manganese nodules; pH 5.5-6.5. Clear to gradual to -

may have B_3-C: Dull yellow orange to bright yellowish brown; may have 20% fine to medium distinct grey mottles; sandy clay to light medium clay, with sand; massive to weak structure; pH 5.5-7.0.

Comments: The profiles with reddish brown B_2 horizons tend to occur on the steeper slopes.

MULEI (Ml)

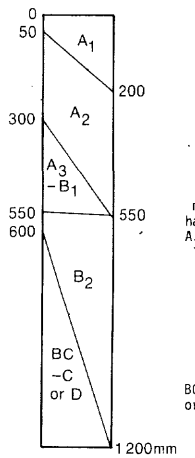
Concept: An acid, yellow, massive gradational soil developed on quartzose sandstone of the Calen Coal Measures, Lizzie Creek Volcanics and associated colluvium.

Principal Profile Form: Gn 2.34, 2.74, 2.94, 2.24.

Great Soil Group: Yellow earth and bleached yellow earth.

Parent Material: Quartzose sandstone and associated alluvial-colluvial material from Calen Coal Measures and Lizzie Creek Volcanics.

Landform: Undulating plains to undulating rises; modal slopes 2-4%.



A_1: Greyish yellow brown; brownish grey to greyish yellow brown (dry), sandy loam; massive; loose to weak hardsetting; pH 5.5-6.0. Clear to -

A_2: Dull yellow orange to dull yellowish brown; light grey to dull yellow orange (dry); sandy loam to sandy clay loam; often conspicuous bleach; massive; pH 5.5-6.0. Gradual to -

may have A_3-B_1: Dull yellowish brown to dull yellow orange, may have 10% fine distinct brown or red mottles; sandy clay loam to sandy clay; massive; pH 5.5-6.0. Gradual to -

B_2: Dull yellow orange, bright yellowish brown, may have 20% fine to medium distinct brown or red mottles; sandy clay to light medium clay; massive; may have 10% iron-manganese nodules; pH 5.0-6.0.

BC-C or D: Buried layers of clay or decomposing sandstone.

OSSA (Os)

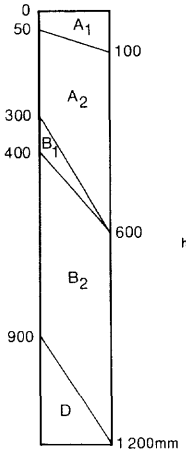
Concept: A neutral, bleached, mottled grey duplex soil developed on alluvial-colluvial material from Carmila Beds and Lizzie Creek Volcanics.

Principal Profile Form: Dy 3.42, 2.42, 3.41; Dg 2.42.

Great Soil Group: Soloth.

Parent Material: Alluvial-colluvial material from Carmila Beds and Lizzie Creek Volcanics.

Landform: Gently undulating to undulating plains; modal slopes 1-3%.



A_1: Brownish grey to greyish yellow; brownish grey to yellowish grey (dry); fine sandy loam to loam, fine sandy occasionally sandy clay loam; hardsetting; massive to weak fine subangular blocky; pH 5.8-6.0. Clear to -

A_2: Brownish grey to dull yellow; light grey (dry); may have 5-10% fine faint to distinct brown mottles; loam fine sandy, fine sandy loam to sandy clay loam; conspicuous bleach; may have 5-15% subangular gravel; massive; pH 5.8-6.0. Abrupt to -

may have B_1: Dark greyish yellow to dull yellow orange; 5-20% medium distinct grey or yellow mottles; light clay, light medium clay gravelly to gravelly light clay; may have 5-20% subangular gravel; pH 5.8-6.0. Clear to gradual to -

B_2: Brownish grey, yellowish grey, greyish olive to grey; 10-30% fine to medium distinct brown or yellow mottles; medium clay, medium heavy clay to medium clay gravelly; may have 10-20% subangular gravel; moderate to strong coarse prismatic breaking to strong medium to coarse angular blocky; 2-5% iron-manganese nodules; pH 6.5-7.5.

may have D: Buried layers of subrounded gravel.

Appendix IV (Continued)

OSSA, cobbly variant (Os 1)

Concept: An acid, bleached, mottled, brown cobbly duplex soil developed on alluvial-colluvial material from the Carmila Beds.

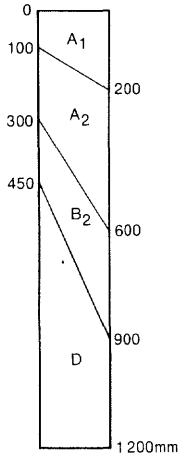
Principal Profile Form: Dy 3.31, 3.42; Db 1.31.

Great Soil Group: No suitable group.

Parent Material: Alluvial-colluvial material from Carmila Beds.

Landform: Gently undulating to undulating plains; modal slopes 1-4%.

Surface Features: 15-50% subrounded cobble and stone.



A_1: Greyish yellow brown to brownish black; brownish grey (dry); sandy clay loam to fine sandy clay loam; massive to weak medium granular; hardsetting; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown; brownish grey to light grey (dry); fine sandy clay loam to sandy clay loam; sporadic to conspicuous bleach; massive; 5-50% subrounded gravel; pH 5.8-6.0. Clear to -

B_2: Dull yellowish brown to brown; 5-40% fine distinct grey mottles; medium clay to gravelly light clay; 10-30% subrounded gravel; 2-5% iron-manganese nodules; moderate structure. Clear to -

D: Buried layers of subrounded gravel.

SEAFORTH (Se)

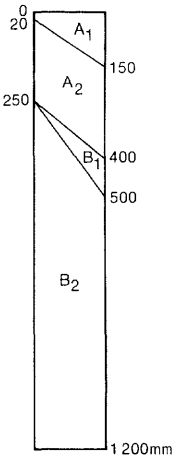
Concept: A neutral, bleached, mottled yellow-grey duplex soil developed on alluvial-colluvial material from Campwyn Beds.

Principal Profile Form: Dy 3.41, 3.42.

Great Soil Group: Soloth.

Parent Material: Alluvial-colluvial material (probably mainly from acid to intermediate volcanics) from Campwyn Beds.

Landform: Gently undulating plains; modal slopes 0-2%.



A_1: Brownish grey to greyish yellow brown; greyish brown to greyish yellow brown (dry); loam, fine sandy to fine sandy clay loam; massive; may have sporadic bleach; pH 5.8-6.0. Clear to -

A_2: Brownish grey to greyish yellow; light grey to dull yellow orange (dry); loam, fine sandy to fine sandy clay loam; conspicuous bleach; may have 15% subrounded gravel; may have 5% iron-manganese nodules; pH 5.8-6.0. Abrupt to -

may have B_1: Greyish yellow brown to dull yellow orange; 5-25% fine distinct yellow to brown mottles; light clay to light medium clay; weak structure; may have 5% iron-manganese nodules; pH 5.8-6.0. Clear to -

B_2: Yellowish grey to dull yellowish brown; 10-40% fine to medium yellow and brown mottles; medium clay to medium heavy clay; weak coarse prismatic breaking to strong coarse angular blocky; may have 15% subrounded gravel; may have 5% iron-manganese nodules; pH 6.0-7.0.

Comments: These soils occasionally overlie gravel.

SEAFORTH, dark B horizon variant (Se 1)

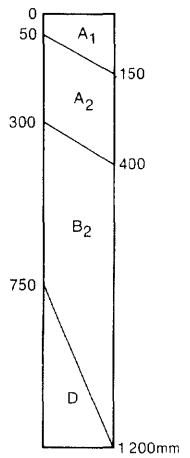
Concept: An acid, bleached, dark duplex soil developed on alluvial-colluvial material from Campwyn Beds.

Principal Profile Form: Dd 1.31, 2.31; Db 2.32, 1.41.

Great Soil Group: Soloth.

Parent Material: Alluvial-colluvial material from Campwyn Beds.

Landform: Alluvial-colluvial flats; modal slopes 0-2%.



A_1: Brown to brownish black; brownish grey to greyish yellow brown (dry); loam, fine sandy to fine sandy clay loam; hardsetting weak structure; pH 5.8-6.0. Clear to -

A_2: Greyish brown to brownish black; brownish grey to greyish yellow brown (dry); loam fine sandy to fine sandy clay loam; sporadic bleach occasionally conspicuous bleach; massive to weak structure; may have 5% iron-manganese nodules; pH 5.8-6.0. Abrupt to clear to -

B_2: Brownish grey, brown to brownish black; whole coloured or may have 30% fine distinct yellow or brown mottles; light medium clay to medium heavy clay; may have feldspathic sand; moderate to strong structure; may have 5% iron-manganese nodules; pH 5.8-6.8. Clear to -

D: Buried layers of gravel.

SEAFORTH, yellow B horizon variant (Se 2)

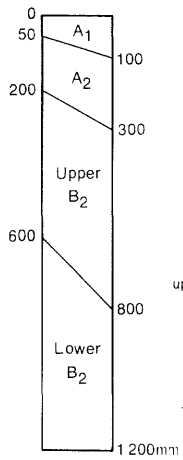
Concept: An acid, bleached yellow duplex soil developed on local alluvium from Campwyn Beds.

Principal Profile Form: Dy 3.41, 2.42.

Great Soil Group: Soloth.

Parent Material: Local alluvium from Campwyn Beds.

Landform: Alluvial flats; modal slopes 0-2%.



A_1: Dark greyish yellow to brownish grey; greyish yellow brown (dry); loam, fine sandy to fine sandy clay loam; may have sporadic bleach; massive; pH 5.8. Clear to gradual to -

A_2: Dull yellow orange to dull yellow; light grey to greyish yellow (dry); fine sandy loam to fine sandy clay loam; conspicuous bleach; massive; may have 2% iron-manganese nodules; pH 5.8-6.0. Abrupt to -

B_2.. upper: Yellowish brown to bright yellowish brown; whole coloured or may have 10% fine distinct pale mottles; medium heavy clay; moderate structure; may have 10% subrounded iron-stained gravel; 1% iron-manganese nodules; pH 5.8-6.0. Gradual to -

B_2.. lower: Bright yellowish brown; 30% fine to medium distinct grey and red mottles; medium heavy clay; moderate structure; may have 10% subrounded iron-stained gravel; may have 2% iron-manganese nodules; pH 5.8-7.0.

Appendix IV (Continued)

BALBERRA (Bb)

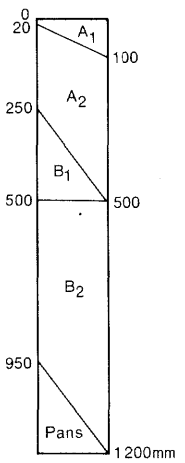
Concept: An acid to neutral, bleached mottled grey duplex soil overlying gravelly pans and developed on alluvial-colluvial material from Carmila Beds.

Principal Profile Form: Dy 3.41, 3.42, 3.81; Dg 2.41.

Great Soil Group: Soloth.

Parent Material: Alluvial-colluvial material (probably from sediments and acid to intermediate volcanics) from Carmila Beds.

Landform: Level to gently undulating plains; modal slopes 0-1%.



A_1: Brownish grey to greyish yellow brown; brownish grey (dry); loam, fine sandy to fine sandy clay loam; may have sporadic bleach; massive; hardsetting; pH 5.8-6.0. Clear to -

A_2: Yellowish grey to greyish brown; light grey (dry); loam, fine sandy to fine sandy clay loam; conspicuous bleach; massive; pH 5.8-6.0. Abrupt to -

may have B_1: Light grey to greyish yellow brown; light clay to light medium clay, with fine sand; sporadic bleach; weak to moderate structure; may have 5% iron-manganese nodules; pH 5.8-6.0. Abrupt to clear to -

B_2: Brownish grey to light grey; 10-40% fine to medium yellow and brown mottles; light medium clay to heavy clay; weak medium prismatic and/or moderate coarse angular blocky; may have 10% subrounded gravels; may have 5-10% iron-manganese nodules; pH 5.8-7.0. Abrupt to -

Pans: Massive, moderately to strongly cemented pan containing iron-stained subrounded gravels; occasionally a massive, moderately to strongly cemented, bleached siliceous pan.

Comments: The sesquioxide pan may occur within 500 mm of the soil surface. In these areas the A_1 and A_2 horizons have sandy clay loam texture and overlie $^1B_1$ horizons with sandy clay to light medium clay, with sand; ^{1}weak to moderate structure; and 15-30% iron-stained, subrounded gravels.

KUTTABUL, alluvial-colluvial variant (Ku 1)

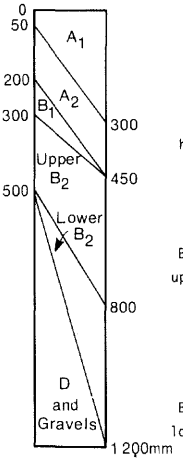
Concept: An acid, bleached yellow duplex soil developed on alluvial-colluvial material from quartzose sandstone in the Calen Coal Measures.

Principal Profile Form: Dy 2.31, 2.41, 2.21, 3.41, 3.42.

Great Soil Group: Yellow podzolic soil.

Parent Material: Alluvial-colluvial material from quartzose sandstone in the Calen Coal Measures.

Landform: Gently undulating plains; modal slopes 1-3%.



A_1: Greyish brown to greyish yellow brown; greyish brown to greyish yellow brown (dry); sandy loam to sandy clay loam and loam, fine sandy; massive; pH 5.5-6.0. Clear to -

A_2: Dull yellow orange to greyish yellow brown and greyish brown; dull yellow orange to light grey (dry); commonly sporadic to conspicuous bleach; light sandy clay loam to sandy clay loam and loam, fine sandy; massive; pH 5.5-6.0. Clear to abrupt to -

may have B_1: Greyish yellow brown to dull yellow orange; 5-15% fine distinct yellow and grey mottles; heavy sandy clay loam to sandy clay; weak structure; may have 10% sandstone gravel; may have 10% iron-manganese nodules; pH 5.5-6.0. Clear to gradual to -

B_2.. upper: Dull yellow orange to bright yellowish brown, occasionally yellowish grey; may have 20% fine distinct grey and red mottles; light medium clay to medium heavy clay; moderate coarse angular blocky breaking to fine subangular blocky; may have 10% sandstone gravel; may have 10% iron-manganese nodules; pH 5.5-6.0. Clear to gradual to -

B_2.. lower: Brownish grey to greyish yellow; 10-30% fine distinct yellow and red mottles; light medium clay to medium heavy clay; moderate coarse angular blocky breaking to fine subangular blocky; may have 10% sandstone gravel; may have 10% iron-manganese nodules; pH 5.5-6.0. Clear to abrupt to -

D: Olive grey to greyish white; 10-40% fine distinct yellow and red mottles; medium clay to heavy clay; moderate to strong structure; may have 10% iron-manganese nodules; pH 5.8-8.0.

CALEN (Cl)

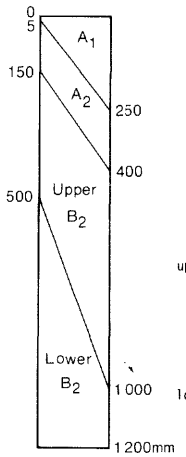
Concept: A neutral to alkaline, bleached mottled grey-yellow duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dy 3.32, 3.33, 3.42, 3.43; Dg 2.43.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains and alluvial flats; modal slopes 0-1%.



A_1: Greyish yellow brown to brownish grey; yellowish grey to greyish brown (dry); sandy clay loam to fine sandy clay loam (occasional loam, fine sandy); may have sporadic bleach; massive; hardsetting; pH 5.5-6.0. Abrupt to clear to -

A_2: Greyish yellow brown to brownish grey; light grey to greyish yellow brown (dry); sandy clay loam to fine sandy clay loam (occasional loam, fine sandy); sporadic to conspicuous bleach; massive; pH 5.5-6.0. Abrupt to clear to -

B_2 upper: Brownish grey to greyish olive and dull yellow orange to bright yellowish brown; 10-40% fine to medium distinct brown yellow or grey mottles; medium clay to heavy clay; moderate to strong structure; may have 10% iron-manganese nodules; may have 10% quartz and feldspathic grit; pH 6.0-7.5. Clear to diffuse to -

B_2 lower: Brownish grey to greyish olive and dull yellow orange to bright yellowish brown; 10-40% fine to medium distinct brown yellow or grey mottles; medium clay to heavy clay; moderate to strong structure; may have 15% carbonate nodules and 10% iron-manganese nodules; may have 10% quartz and feldspathic grit; pH 7.5-9.0.

Comments: Occasionally profiles with whole coloured upper B_2 horizons occur. D horizons with contrasting colours and/or an increase in feldspathic and quartz sand occur. Those profiles with neutral reaction trend at 1 200 mm would be expected to become alkaline at depth.

NARPI (Nr)

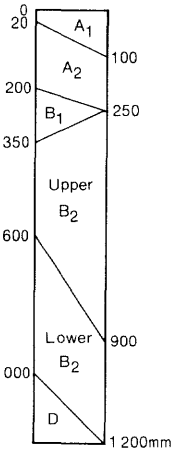
Concept: An alkaline, bleached, mottled grey duplex soil overlying a grey clay D horizon and developed on Quaternary alluvium.

Principal Profile Form: Dy 3.33, 3.32, 3.43; Gn 3.03.

Great Soil Group: Solodic.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains; modal slopes 0-1% and extensive stable gullies.



A_1: Dark greyish yellow to brownish grey; brownish grey (dry); 5-15% brown root-line mottles; fine sandy clay loam to silty clay loam; may have sporadic bleach; hardsetting; weak to moderate medium granular; pH 5.8-6.0. Clear to -

A_2: Dark greyish yellow to brownish grey; brownish grey to light grey (dry); fine sandy clay loam to silty clay loam; sporadic or occasional conspicuous bleach; pH 5.8-6.0. Clear to -

may have B_1: Dark greyish yellow to brownish grey; light clay to light medium clay; sporadic bleach. Clear to -

B_2 upper: Brownish grey, greyish yellow brown to yellowish brown; 10-30% fine distinct yellow, brown or grey mottles; medium heavy clay to heavy clay; weak coarse prismatic breaking to strong medium angular blocky; 1-5% iron-manganese nodules; pH 6.5-7.5. Gradual to -

B_2 lower: Similar to upper B with 5-15% carbonate nodules; pH 8.0-9.0.

D: Brownish grey to grey; heavy clay; pH 8.5-9.0.

Appendix IV (Continued)

ETON (Eo)

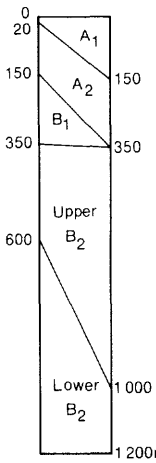
Concept: An alkaline, bleached, mottled dark to grey duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dd 2.33, 1.33; Dy 3.33; Gn 3.03.

Great Soil Group: Solodic - solodized solonetz soil.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains and flats; slopes 0-1 .



A_1: Yellowish and brownish grey to brownish black; yellowish grey to greyish yellow brown (dry); may have 10% fine distinct rootline mottles; fine sandy clay loam; weak structure; hardsetting; pH 5.5-6.0. Clear to -

A_2: Yellowish grey and brownish grey to brownish black; yellowish grey to greyish yellow brown (dry); may have 10% fine distinct rootline mottles; fine sandy clay loam; sporadic bleach; weak structure; hardsetting; pH 5.5-6.0. Clear to abrupt to -

may have B_1: Yellowish grey to brownish black; may have 10% fine distinct yellow mottles; light clay, with fine sand to light medium clay, with fine sand; commonly sporadic bleach; weak to moderate structure; pH 5.5-6.0. Clear to -

B_2.. upper: Brownish black to greyish yellow brown and yellowish grey; 5-20% fine to medium distinct yellow and brown mottles; light medium clay to heavy clay; moderate structure; 2-10% iron-manganese nocules; pH 6.0-8.0. Clear to gradual to -

B_2.. lower: Brownish grey to dark greyish yellow and olive yellow to bright yellowish brown; 10-40% fine to medium distinct yellow and grey mottles; medium clay to heavy clay; moderate structure; 5-15% iron-manganese nodules; 10-20% nodular and soft carbonate; pH 8.0-9.0.

SUNNYSIDE (Su)

Concept: An alkaline, bleached, mottled, silty, grey-olive duplex soil developed on Quaternary alluvium.

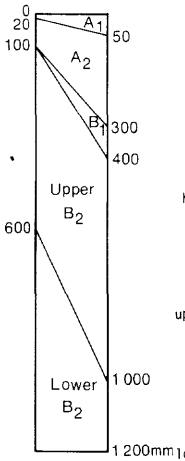
Principal Profile Form: Dy 3.43, 3.42, 3.32, 3.33; Gn 3.06.

Great Soil Group: No suitable group (Affinities with solodic - solodized solonetz soil).

Parent Material: Quaternary alluvium.

Lancform: Alluvial plain; modal slopes 0-1 .

Surface Features: Debil debil microrelief in uncultivated areas.



A_1: Brownish grey to dark greyish yellow; greyish yellow (dry); 5-10% rootline mottles; silty clay loam to fine sandy clay loam; may have sporadic bleach; hardsetting; moderate fine subangular blocky; pH 5.8-6.0. Clear to -

A_2: Brownish grey to dark greyish yellow; light grey (dry); 5-10% rootline mottles; silty clay loam to fine sandy clay loam; conspicuous bleach; moderate structure; pH 5.8-6.0. Abrupt to -

may have B_1: Brownish grey to dull yellow; 5-20% fine distinct yellow to brown mottles; medium clay to silty clay; sporadic bleach; weak to moderate structure; may have 5% iron-manganese nodules; pH 5.8-7.0. Abrupt to -

B_2 upper: Dull yellow, olive grey to brownish grey; 10-30% fine to medium distinct yellow and grey mottles; medium heavy clay to heavy clay; moderate very coarse angular blocky breaking to strong medium angular blocky; 2-10% iron-manganese nodules; pH 6.5-8.0. Gradual to -

B_2 lower: Olive yellow to yellowish grey; 10-40% medium distinct yellow and grey mottles; heavy clay; strong structure; 2-10% iron-manganese nodules; may have 2-20% carbonate nodules; pH 8.0-9.0.

Comments: The pH in the lower B horizon is occasionally only pH 7.0 by 1 200 mm.

SANDIFORD (Sa)

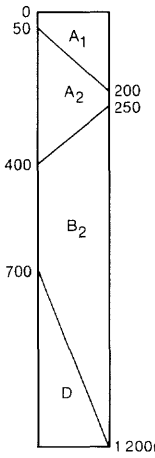
Concept: An acid to neutral, bleached, mottled, yellow duplex soil overlying sandy D horizons and developed in Quaternary alluvium.

Principal Profile Form: Dy 3.41, 3.42, 3.31, 3.32; Dg 2.41.

Great Soil Group: Yellow podzolic soil - soloth.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains; modal slopes 0-1%.



A_1: Brownish grey to greyish yellow brown; brownish grey (dry); sandy clay loam to light sandy clay loam; hardsetting; massive; pH 5.8-6.0. Clear to gradual to -

A_2: Greyish brown to yellowish grey; light grey to greyish yellow brown (dry); light sandy clay loam to sandy clay loam; sporadic to conspicuous bleach; massive; pH 5.8-6.0. Clear to abrupt to -

B_2: Dark greyish yellow, dull yellow orange to bright yellowish brown; 10-40% fine to medium distinct yellow, brown or grey mottles; light medium clay to medium heavy clay; medium to coarse feldspathic and quartz sand; moderate to strong structure; 2-10% iron-manganese nodules; pH 6.0-8.0. Clear to gradual to -

D: Buried layers of dull yellowish brown to bright yellowish brown; whole coloured or 10-30% grey or yellow mottles; sandy loam to light medium clay; pH 6.0-8.0.

Comments: Some profiles have sandy loam A horizons.

MARIAN (Ma)

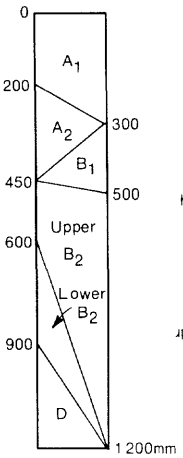
Concept: A neutral, bleached, mottled, brown duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dy 3.32, 2.32; Db 2.32; Dy 3.12; Db 2.12.

Great Soil Group: No suitable group.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains and some levees; modal slopes 0-1%.



A_1: Brownish grey to brownish black; brownish grey to greyish brown (dry); sandy clay loam to fine sandy clay loam; massive to weak fine subangular blocky; hardsetting; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown to brownish grey; brownish grey to greyish yellow brown (dry); sandy clay loam to fine sandy clay loam; sporadic bleach; massive to weak fine subangular blocky; 5-15% iron-manganese nodules; pH 5.8-6.0. Clear to abrupt to -

may have B_1: Dull yellowish brown to brownish grey; may have 5-15% fine distinct brown mottles; sandy clay to light clay; may have sporadic bleach; weak to moderate structure; commonly 10-20% iron-manganese nodules; pH 5.8-6.0. Clear to abrupt to -

B_2 upper: Greyish yellow brown, dull yellowish brown to brown; 5-20% fine to medium distinct brown or grey mottles; light medium clay to medium heavy clay; weak to moderate medium prismatic breaking to weak to moderate medium to coarse subangular blocky; may have feldspathic grit; may have 2-10% iron-manganese nodules; pH 6.5-7.0. Diffuse to -

B_2 lower: Dull yellowish brown, bright yellowish brown to orange; 10-20% fine to medium distinct grey mottles; medium clay to medium heavy clay; weak to moderate structure; may have feldspathic grit; pH 6.5-7.5.

D: Variable texture but generally sandy clay to medium clay, with sand.

Appendix IV (Continued)

MARIAN, yellow B horizon variant (Ma 1)

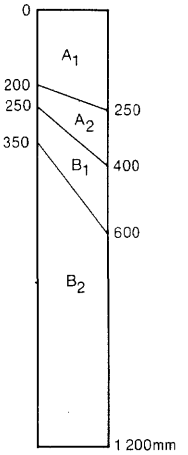
Concept: An acid to neutral, bleached, yellow duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dy 3.32, 3.42, 2.32.

Great Soil Group: Yellow podzolic soil.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains; modal slopes 0-1%.



A_1: Brownish grey to greyish brown; brownish grey (dry); light sandy clay loam to sandy clay loam; occasionally fine sandy clay loam; massive to weak structure; hardsetting; pH 5.8-6.0. Clear to gradual to -

A_2: Brownish grey to greyish yellow brown; brownish grey to light grey (dry); light sandy clay loam to sandy clay loam, occasionally fine sandy clay loam; sporadic to conspicuous bleach; massive; pH 5.8-6.0. Clear to -

B_1: Greyish yellow brown to dull yellow orange; may have 5-15% fine distinct brown mottles; sandy clay to light clay, with sand; may have sporadic bleach; massive; may have 5-10% iron-manganese nodules; pH 6.0-7.0. Clear to -

B_2: Bright yellowish brown to dull yellow orange; 5-20% fine to medium distinct brown or grey mottles; medium clay to medium heavy clay; moderate structure; 2-15% feldspathic grit; 2-5% iron-manganese nodules; pH 6.0-7.0.

MIRANI (Mi)

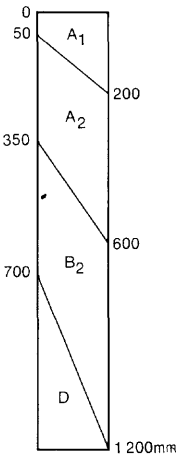
Concept: An acid to neutral, bleached, mottled grey-yellow sandy duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dy 5.81, 3.81, 3.41, 3.42; Dg 4.41.

Great Soil Group: Yellow - gleyed podzolic soil.

Parent Material: Quaternary alluvium.

Landform: Low elongate rises (0.5 - 2 m) on alluvial plains; modal slopes 0-1%.



A_1: Brownish grey to greyish yellow brown; brownish grey (dry); sandy loam to light sandy clay loam; loose to weak hardsetting; massive; pH 5.8-6.0. Clear to -

A_2: Greyish brown, dark greyish yellow to dull yellow orange; light grey to light yellow orange (dry); sandy loam to sandy clay loam; massive; conspicuous bleach; may have 10% iron-manganese nodules; pH 5.5-6.0. Abrupt to -

B_2: Light grey, greyish yellow brown to dull yellow; 10-40% medium distinct grey, brown and yellow mottles; sandy clay to medium clay; moderate to weak structure; may have 5-20% feldspathic and quartz grit; 2-10% iron-manganese nodules; pH 5.8-7.0. Clear to -

D: Buried layers with variable features; sandy clay loam to medium clay; pH 6.0-7.0.

VICTORIA PLAINS (Vc)

Concept: An alkaline, black, self-mulching, cracking clay developed on Quaternary alluvium.

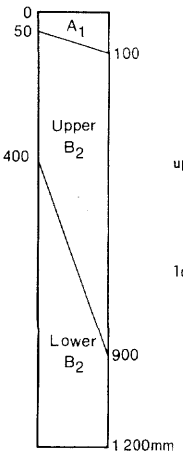
Principal Profile Form: Ug 5.16.

Great Soil Group: Black earth.

Parent Material: Quaternary alluvium.

Landform: Depression areas or drainage lines in alluvial plains; modal slopes 0%.

Surface Features: Incipient normal gilgai development. Debil debil micro-relief in areas with poor external drainage.



A_1: Black to brownish black; brownish black to brownish grey (dry); 5-10% rootline mottles; light medium clay to medium heavy clay; strong fine to medium subangular blocky and strong medium granular; cracking; self-mulching; pH 5.8-6.0. Clear to gradual to -

B_2 upper: Black to brownish black; may have 5-10% medium distinct brown mottles; medium clay to heavy clay; moderate coarse angular blocky; 1-5% iron-manganese nodules; pH 6.5-7.5. Clear to gradual to -

B_2 lower: Greyish olive, brownish grey to grey; 5-20% fine, medium or coarse distinct yellow mottles; heavy clay; strong coarse blocky and lenticular; 2-5% iron-manganese nodules; 2-20% carbonate nodules; pH 8.5-9.0.

BRIGHTLEY (Bt)

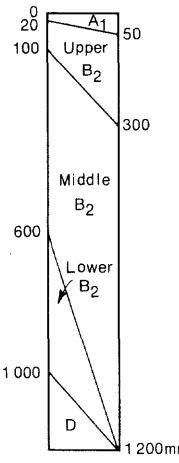
Concept: An alkaline, grey, self-mulching, cracking clay developed on Quaternary alluvium.

Principal Profile Form: Ug 5.24, 5.28, 5.16, 5.17.

Great Soil Group: Grey clay.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains; modal slopes 0-1%.



A_1: Brownish black to brownish grey; brownish grey (dry); light clay to light medium clay; cracking; weakly self-mulching; pH 5.8-6.0. Clear to -

B_2 upper: Brownish black to greyish yellow brown; light clay to medium clay; moderate to strong fine blocky; pH 5.8-6.0. Gradual to -

B_2 middle: Brownish grey, greyish yellow brown to grey; may have 15% fine to medium faint to distinct brown or yellow mottles; medium heavy clay to heavy clay; strong structure; may have 5% iron-manganese nodules; may have feldspathic grit; pH 6.5-7.5. Gradual to diffuse to -

B_2 lower: Brownish grey, dull yellowish brown to greyish olive; 5-30% fine to medium distinct yellow brown or grey mottles; medium heavy clay to heavy clay; moderate to strong structure; may have 5% iron-manganese nodules; may have 20% carbonate nodules; pH 8.0-9.0. Clear to gradual to -

may have D: Variable features with either lighter texture, contrasting colours or increased feldspathic grit.

Comments: Some profiles have a weakly developed sporadic bleach in the A horizon.

Appendix IV (Continued)

BENHOLME (Bh)

Concept: An alkaline, bleached, mottled, grey-yellow cracking clay developed on Quaternary alluvium.

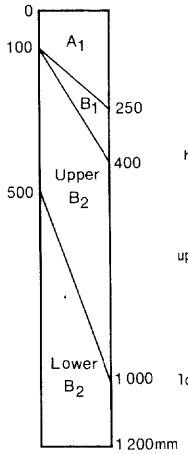
Principal Profile Form: Ug 5.24, 5.28, 3.2.

Great Soil Group: Grey clay.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains; modal slopes 0-1%.

Surface Features: Incipient normal gilgai (vertical interval 100 - 200 mm, horizontal interval 1 - 2 m).



A_1: Greyish yellow brown to greyish brown; greyish yellow brown to brownish grey (dry); may have 20% fine distinct rootline mottles; light clay to light medium clay; sporadic bleach (10-50%); moderate structure; hardsetting; pH 5.5-6.0. Clear to gradual to -

may have B_1: Brownish grey to greyish olive; 10-20% fine distinct brown mottles; medium clay; sporadic bleach; strong structure; may have 1-5% iron-manganese nodules; pH 5.5-6.5. Clear to gradual to -

B_2 upper: Yellowish grey, brownish grey to greyish olive and greyish yellow brown to dull yellow orange; 10-40% fine to medium distinct yellow and brown mottles; medium heavy clay to heavy clay; strong structure; 5-15% iron-manganese nodules; pH 5.8-7.0. Gradual to diffuse to -

B_2 lower: Brownish grey to greyish olive and dull yellow orange; may have 20% fine to medium distinct brown and yellow mottles; mecium heavy clay to heavy clay; strong structure; 10-20% iron-manganese nodules; may have 20% carbonate nodules; pH 8.0-9.0.

Comments: Occasionally a Dy with silty clay loam A horizons occurs in the gilgai depressions.

DUNDULA (Dn)

Concept: An alkaline, bleached mottled grey-brown cracking clay developed on Quaternary alluvium.

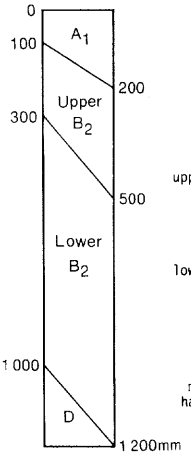
Principal Profile Form: Ug 5.24, 5.28.

Great Soil Group: Grey clay.

Parent Material: Quaternary alluvium.

Landform: Alluvial plains slightly elevated above drainage lines; modal slopes 0-1%.

Surface Features: Incipient normal gilgai (vertical interval 100 mm, horizontal interval 2 m).



A_1: Greyish yellow brown to yellowish grey; brownish grey to greyish yellow (dry); 5-15% fine distinct brown mottles; light clay to light medium clay; may have silt or fine sand; sporadic bleach; moderate structure; cracking; hardsetting to weakly self-mulching; pH 5.8-6.0. Clear to -

B_2 upper: Brownish grey to dull yellowish brown; 10-30% medium distinct brown mottles; medium clay to heavy clay; strong structure; may have 1-5% iron-manganese nodules; pH 6.0-6.5. Gradual to -

B_2 lower: Yellowish grey to greyish olive and yellowish brown to dull yellow orange; 10-20% medium faint to distinct yellow and grey mottles; medium heavy clay to heavy clay; moderate to strong structure; may have 1-5% iron-manganese nodules; may have 10% carbonate nodules from 1 000 mm; pH 8.0-8.5. Clear to -

may have D: Similar colours to B_2 lower horizon but with sandy clay to medium heavy clay with sand or coarse sand.

KINCHANT (Kc)

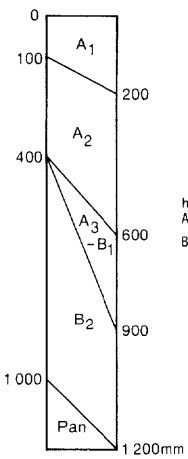
Concept: An acid, bleached, yellow-gleyed, sandy duplex soil overlying a pan and developed on relict plains of alluvium.

Principal Profile Form: Dy 5.81, 5.41; Dg 4.81, 4.41.

Great Soil Group: Soloth.

Parent Material: Alluvium; possibly of Tertiary age.

Landform: Level to gently undulating plains 5 - 10 m above adjacent alluvial plains; modal slopes 0-2%.



A_1: Brownish grey; brownish grey (dry); loamy sand to sandy loam; massive; loose; feldspathic and quartz grit; pH 5.5-6.0. Clear to -

A_2: Greyish yellow brown to dull yellow orange; light grey (dry); coarse sand to loamy sand; conspicuous bleach; massive; may have 15% iron-manganese nodules; feldspathic and quartz grit; pH 5.5-6.0. Clear to gradual to -

may have A_3-B_1: Greyish yellow brown to bright yellowish brown; 10-20% medium distinct grey or yellow mottles; sandy clay loam to sandy clay; massive; may have 15% iron-manganese nodules; feldspathic and quartz grit; pH 5.5-6.0. Abrupt to clear to -

B_2: Light grey, bright yellowish brown and dull yellow orange; 10-50% coarse distinct grey and yellow mottles; light medium clay with sand to medium heavy clay with sand; weak to moderate coarse prismatic; may have 1-5% iron-manganese nodules; feldspathic and quartz grit; pH 5.0-6.0. Abrupt to -

1 200mm Pan: Massive; moderately to strongly cemented; feldspathic and quartz grit; light grey; 10-20% medium distinct yellow and brown mottles.

Comments: The A horizons directly overlie the cemented pan in some profiles, Uc 2.

KINCHANT, coarse sandy variant (Kc 1)

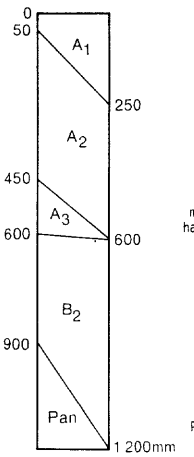
Concept: An acid, bleached, yellow-gleyed, coarse sandy duplex soil overlying a pan and developed on relict plains of alluvial to alluvial-colluvial material.

Principal Profile Form: Dy 5.81; Dg 4.81.

Great Soil Group: Gleyed podzolic soil.

Parent Material: Alluvial to alluvial-colluvial material; possibly of Tertiary age.

Landform: Gently undulating plains 2 - 10 m above adjacent alluvial plains; modal slopes 1-3%.



A_1: Brownish grey to brownish black; brownish grey (dry); loamy coarse sand to coarse sandy loam; may have sporadic bleach; massive; loose to weak hardsetting; pH 5.8-6.0. Abrupt to clear to -

A_2: Greyish brown, greyish yellow brown and dull yellow orange; light grey (dry); coarse sand to coarse sandy loam; conspicuous bleach; massive; pH 5.5-6.0. Abrupt to clear to -

may have A_3: Dull yellow orange, light grey (dry); light sandy clay loam, coarse sandy; massive; pH 5.5-6.0. Abrupt to clear to -

B_2: Light grey to greyish white and dull yellow to yellowish brown; 10-25% fine to medium distinct yellow and red mottles; coarse sandy clay to medium heavy clay with coarse sand; massive to weak structure; may have 10% iron-manganese nodules; feldspathic and quartz grit; pH 5.5-6.0. Abrupt to -

Pan: Massive; moderately to strongly cemented; feldspathic and quartz grit and some subangular gravels.

Appendix IV (Continued)

ALLANDALE (Al)

Concept: An acid to neutral, bleached, yellow-brown duplex soil overlying a pan and developed on relict plains of alluvium.

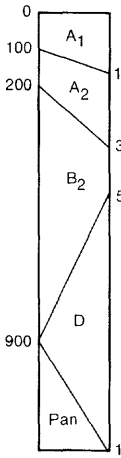
Principal Profile Form: Dy 3.31, 3.41, 3.42, 3.32.

Great Soil Group: Soloth.

Parent Material: Alluvium; possibly of Tertiary age.

Landform: Level to gently undulating plains 5 - 10 m above adjacent alluvial plains; modal slopes 0-1%.

Surface Features: Debil debil and normal gilgai (vertical interval 300 mm, horizontal interval 2 m) evident in some areas.



A_1: Greyish yellow brown to brownish grey; brownish grey (dry); light sandy clay loam to sandy clay loam; massive; hardsetting; pH 5.8-6.0. Clear to -

A_2: Greyish yellow brown to brownish grey; brownish grey to light grey (dry); may have 10% fine distinct brown mottles; light sandy clay loam to sandy clay loam; sporadic to conspicuous bleach; massive; may have 5-10% iron-manganese nodules; pH 5.8-6.0. Abrupt to -

B_2: Dull yellowish brown, dull yellow orange to greyish yellow; 10-30% medium distinct grey, yellow and brown mottles; light medium clay to medium heavy clay; moderate to strong structure; may have 5% iron-manganese nodules; pH 5.8-7.0. Clear to -

may have D: Greyish yellow, dull yellow orange to light grey; 10-20% medium distinct grey and yellow mottles; sandy clay to medium heavy clay; may have 1-5% iron-manganese nodules; may have 1-10% carbonate nodules; pH 6.0-9.0.

and/or Pan: Massive; moderately to strongly cemented; feldspathic and quartz grit; light grey; 10-20% medium distinct yellow and brown mottles; pH 6.0-9.5.

Comments: Some profiles have a sandy loam A horizon texture and intergrade to Kinchant soils.

ALLANDALE, strongly sodic variant (Al 1)

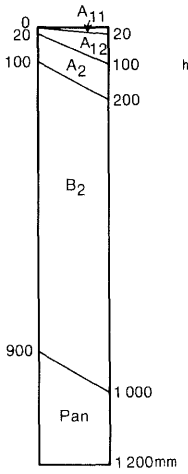
Concept: A strongly alkaline, bleached yellow-brown duplex soil overlying a pan and developed on relict plains of alluvium.

Principal Profile Form: Dy 2.43.

Great Soil Group: Solodized - solonetz soil.

Parent Material: Alluvium; possibly of Tertiary age.

Landform: Level to gently undulating plains 5 - 10 m above adjacent alluvial plains; modal slopes 0-1%.



may have A_{11}: Brownish black; brownish grey (dry); organic sandy loam to organic loam; massive; pH 5.5. Abrupt to -

A_{12}: Greyish yellow brown; brownish grey (dry); sandy loam to light sandy clay loam; massive; hardsetting; pH 6.0. Clear to -

A_2: Brownish grey, light grey (dry); may have 10% fine distinct brown mottles; sandy loam; conspicuous bleach; massive; pH 6.0. Abrupt to -

B_2: Dull yellowish brown to dull yellow orange; whole coloured but may have 10-15% fine distinct yellow or grey mottles at depth; sandy clay to medium clay with sand; strong coarse columnar structure; pH 8.5-9.5. Clear to -

Pan: Massive; moderately to strongly cemented; feldspathic and quartz grit; light grey; 10-20% medium distinct yellow and brown mottles; pH 9.5.

PIONEER (Pn)

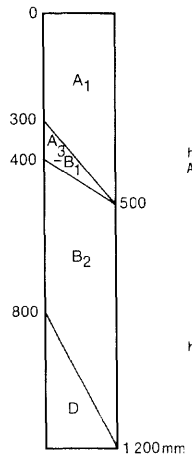
Concept: An acid to neutral, red-brown duplex soil developed on levees of Quaternary alluvium.

Principal Profile Form: Db 1.11, 1.12, 1.51, 1.52, 2.11; Dy 2.11.

Great Soil Group: Non calcic brown soil.

Parent Material: Quaternary alluvium.

Landform: Levees; modal slopes 0-4%.



A_1: Brownish black to greyish brown; greyish brown (dry); sandy clay loam to clay loam sandy; hardsetting; massive to weak moderate granular; pH 5.8-6.0. Clear to gradual to -

may have A_3-B_1: Brownish black to brown; clay loam to sandy clay; pH 6.0. Clear to -

B_2: Brown to bright brown; whole coloured or may have 5-10% fine distinct red or yellow mottles; light medium clay to medium clay; feldspathic sand; massive or weak to moderate fine subangular blocky; may have 5% iron-manganese nodules; pH 6.0-6.5.

may have D: Buried layers of brown; sandy clay loam to sandy loam; pH 7.0.

Comment: There is no suitable great soil group for those profiles with massive to weak B horizon structure.

PIONEER, red B horizon variant (Pn 1)

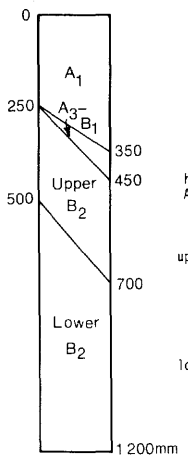
Concept: A neutral, red duplex soil developed on Quaternary alluvium.

Principal Profile Form: Dr 2.12.

Great Soil Group: Non calcic brown soil.

Parent Material: Quaternary alluvium.

Landform: Terraces and levees; modal slopes 0-1%.



A_1: Brownish black to dark reddish brown; brownish grey to greyish brown (dry); sandy clay loam to clay loam sandy; hardsetting; massive to weak medium granular; pH 5.8-6.0. Clear or abrupt to -

may have A_3-B_1: Reddish brown to brown; sandy clay loam to sandy clay; pH 5.8-6.0. Clear to -

B_2 upper: Reddish brown; light medium clay, medium clay to medium heavy clay; moderate fine to medium subangular blocky; feldspathic sand; 2-5% iron-manganese nodules; pH 5.8-6.0. Gradual to -

B_2 lower: Reddish brown; may have 5-20% fine distinct yellow or grey mottles; medium clay to medium heavy clay; feldspathic sand; 5-10% iron-manganese nodules; pH 6.5-7.0.

Appendix IV (Continued)

ST. HELENS (St)

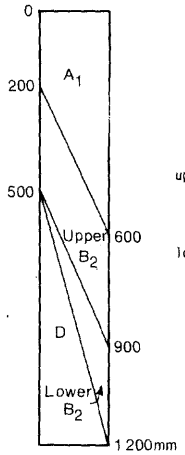
Concept: An acid to neutral, dark gradational soil developed on stream terraces of Quaternary alluvium.

Principal Profile Form: Gn 3.41, 3.42; Uf 6.32; Gn 3.92.

Great Soil Group: Prairie soil, minimal prairie soil.

Parent Material: Quaternary alluvium.

Landform: Stream terraces and floodplains; modal slopes 0-2% ranging to 6%.



A_1: Brownish black to black; brownish grey to greyish yellow brown (dry); fine sandy clay loam, light clay and sandy clay loam; weakly hardsetting; weak to moderate structure; pH 5.8-6.0. Gradual to -

B_2 upper: Brownish black to brownish grey; light clay to medium clay; moderate structure; may have fine sand or sand; pH 5.8-6.5. Gradual to diffuse to -

B_2 lower: Dull yellowish brown to dark reddish brown; may have 40% fine to medium distinct dark mottles; light clay to medium heavy clay; may have fine sand or sand; moderate structure; may have 1-5% iron-manganese nodules; pH 6.0-7.0.

D: Dull yellowish brown, bright brown to brownish grey; sandy loam to sandy clay or gravel; pH 6.0-7.0.

CAMERON (Cm)

Concept: An acid to neutral, brown, massive, uniform loam to gradational soil developed on stream terraces and floodplains of Quaternary alluvium.

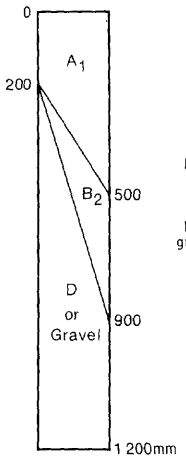
Principal Profile Form: Um 1.43, 1.41; Um 5.5; Gn 2.41, 2.82.

Great Soil Group: Alluvial soil and no suitable group.

Parent Material: Quaternary alluvium.

Landform: Stream terraces and floodplains; modal slopes 0-2%.

Surface Features: May have 5-15% rounded gravel and cobble.



A_1: Brownish grey, dull yellowish brown to brownish black; brownish grey to greyish yellow brown (dry); sandy clay loam, fine sandy clay loam to light sandy clay loam; massive; hardsetting; may have 5% rounded gravel and cobble; pH 5.5-6.5. Clear to diffuse to -

may have B_2: Greyish yellow brown to brown; sandy clay loam to sandy clay; massive; may have 5-10% rounded cobble and gravel; pH 5.8-7.0.

D or gravel: Sand, sandy loam or gravel (rarely a deep profile to 1 200 mm).

Comments: Cameron profiles intergrade to St. Helens profiles, particularly along Cattle Creek.

MURRAY (Mu)

Concept: An acid sand on floodplains of Quaternary alluvium.

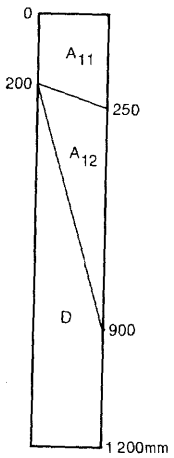
Principal Profile Form: Uc 1.2, 5.11

Great Soil Group: Alluvial soil.

Parent Material: Quaternary alluvium.

Landform: Floodplains; modal slopes 0-2%.

Surface Features: 0-40% rounded gravel and cobble.



A_{11}: Greyish yellow brown, brown to brownish black; light grey to dull brown (dry); loamy sand to sandy loam; loose; single grain to weak medium granular; pH 5.8-6.2. Gradual to -

A_{12}: Dull yellowish brown to brown; loamy sand, sandy loam to sand; single grain; pH 5.8-6.5.

D: Buried layers of sand, sandy loam or gravel.

ANDERGROVE (An)

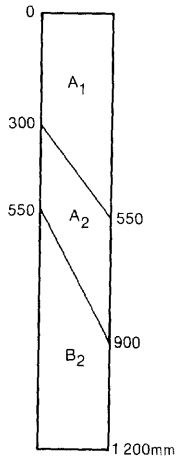
Concept: An acid, bleached sand with a yellow B horizon developed on Quaternary sand deposits.

Principal Profile Form: Uc 2.21, 2.22, 2.23.

Great Soil Group: Rudimentary podzol.

Parent Material: Quaternary sand deposits of marine origin.

Landform: Beach ridges and coastal dunes, other than foredunes; modal slopes 0-3%.



A_1: Greyish yellow brown to brownish black; brownish grey to greyish brown (dry); sand to sandy loam; single grain structure; loose; pH 5.5-6.0. Clear to gradual to -

A_2: Greyish yellow brown to dull yellow orange; light grey to dull yellow orange (dry); sand to loamy sand; conspicuous bleach; single grain structure; pH 5.8-6.5. Gradual to diffuse to -

B_2: May be whole coloured dull yellow orange to bright yellowish brown or light grey (moist), with 10-20% medium distinct yellow mottles; sand to loamy sand; single grain structure; may have 10% iron concretions; pH 5.8-7.0.

Comments: Augered profiles to 3 m indicate that associated with the Uc profiles are Dy 5.82 or Dg 4.81 profiles with a sandy clay B horizon below 1 300 - 2 000 mm.

Appendix IV (Continued)

ANDERGROVE, coarse sandy variant (An 1)

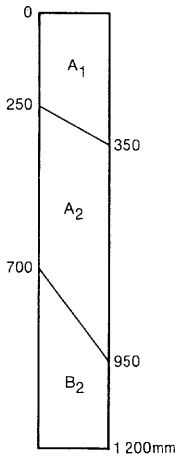
Concept: An acid, bleached, coarse sand overlying yellow-gleyed sandy clay and developed on Quaternary sand deposits.

Principal Profile Form: Dy 5.81, 5.82; Dg 4.81.

Great Soil Group: Yellow-gleyed podzolic soil.

Parent Material: Quaternary sand deposits of marine origin.

Landform: Beach ridges; modal slopes 0-2%.



A_1: Greyish yellow brown to brownish grey; brownish and light grey (dry); loamy coarse sand to coarse sandy loam; single grain structure; loose; pH 5.5-6.0. Gradual to -

A_2: Greyish yellow brown; light grey (dry); coarse sand to coarse sandy loam; conspicuous bleach; single grain structure; pH 5.5. Abrupt to clear to -

B_2: Brownish grey, light grey and bright yellowish brown; 15-20% medium prominent brown or grey mottles; coarse sandy clay; massive; may have 5% iron-manganese nodules; pH 5.5-7.0.

ANDERGROVE, calcareous variant (An 2)

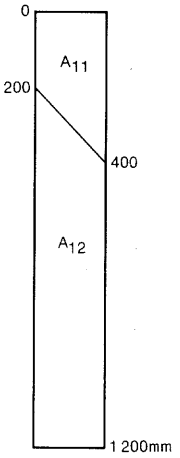
Concept: An alkaline, brown sand developed on Quaternary sand deposits.

Principal Profile Form: Uc 1.1.

Great Soil Group: Calcareous sand.

Parent Material: Quaternary sand deposits of marine origin.

Landform: Coastal sand dunes or beach ridges; modal slopes 0-4%.



A_{11}: Dark reddish brown; greyish brown (dry); sand; single grain; loose; pH 8.0. Gradual to -

A_{12}: Light brownish grey (dry); sand; single grain; 5-10% small fragments of pumice and coral; pH 8.0-8.5.

NEILS (N1)

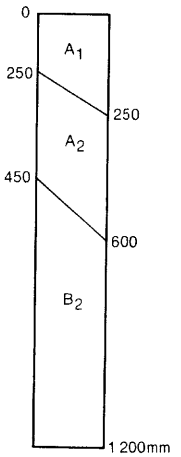
Concept: An acid, bleached, yellow-gleyed, fine sandy duplex soil developed on Quaternary sand deposits.

Principal Profile Form: Dy 5.81, 5.82; Dg 4.81.

Great Soil Group: Yellow and gleyed podzolic soil.

Parent Material: Quaternary sand deposits.

Landform: Coastal dunes or degraded beach ridges; modal slopes 1-3%.



A_1: Brownish black to greyish yellow brown; brownish grey (dry); loamy fine sand to sandy loam; weak medium granular; loose; pH 5.8-6.0. Clear to -

A_2: Brownish grey to greyish yellow brown; light grey (dry); fine sand to loamy sand; conspicuous bleach; massive; 5-15% iron-manganese concretions; pH 5.8-6.5. Abrupt to -

B_2: Yellowish brown, bright yellowish brown, dull yellow orange to light grey; 10-30% distinct to prominent red, brown or grey mottles; massive; 5-10% iron-manganese concretions; pH 5.5-6.0.

APPENDIX V

MORPHOLOGICAL AND ANALYTICAL DATA FOR REPRESENTATIVE SOIL PROFILES

SOIL TYPE: Whiptail
SITE NO: MCL S01
A.M.G. REFERENCE: 676 200 mE 7 693 200 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.31
SOIL TAXONOMY UNIT: Aquic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Trachyte
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus crebra; Eucalyptus papuana; Eucalyptus intermedia; Melaleuca nervosa; Heteropogan triticeus; Themeda australis

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish black (7.5YR3/2) moist; brownish grey (10YR6/1) dry; few fine distinct grey mottles; few fine faint yellow mottles; sandy clay loam; weak 2-5mm platy; dry very firm. Abrupt; to-
A2sb	.05 to .28 m	Greyish brown (7.5YR4/2) moist; brownish grey (10YR6/1) dry; few fine distinct yellow mottles; sandy clay loam; few angular trachyte; dry very firm. Abrupt; to-
B21	.28 to .44 m	Bright yellowish brown (10YR7/6) moist; few fine distinct brown mottles, few fine distinct red mottles; medium clay; dry moderately strong; slightly calcareous. Clear, to-
B22	.44 to .95 m	Dull yellowish orange (10YR7/4) moist; common medium distinct gley mottles; light medium clay; few angular trachyte; dry moderately strong; non-calcareous. Diffuse, to-
B23	.95 to 1.20 m	Light yellow (2.5Y7/3) moist; many medium distinct yellow mottles, few medium distinct red mottles; medium clay; dry moderately strong; non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.05	5.8	.03	.002	14	59	12	14	8	2.7	2.0	.17	.25	.025	0.60	.021	1.6	18	7		
.20	5.6	.03	.002													1.3				
.30	5.9	.03	.003	8	53	21	21	6	1.4	1.8	.41	.05	.016	0.68	.012	1.4	19	9		
.40	5.8	.15	.017													2.9				
.60	6.0	.32	.042	2	34	16	50	12	.92	8.9	5.1	.11	.005	2.68	.006	2.7	31	19		
.90	6.1	.33	.044	2	52	17	.2	81	1.3	47.	97.	1.0	.006	2.82	.005	2.3	62	31	2	
1.20	5.6	.46	.063	11	46	11	30	20	.20	8.9	12	.10	.012	2.99	.010	2.8				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
.5	2.1	.10	8	8	.32				
.20	1.1	.06	3	10	.07				

SOIL TYPE: Calen
SITE NO: MCL S02
A.M.G. REFERENCE: 676 400 mE 7 697 800 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.42
SOIL TAXONOMY UNIT: Aquic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus alba; Tristania sauveolens

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .10 m	Brownish black (10YR3/2) moist; brownish grey (10YR6/1) dry; sandy clay loam; weak; dry very firm. Gradual, to-
A12	.10 to .26 m	Dark greyish yellow (2.5Y4/2) moist; yellowish grey (2.5Y6/1) dry; sandy clay loam; weak; dry very firm. Abrupt; to-
A2	.26 to .30 m	Light grey (10YR8/2) dry; sandy clay loam; weak; dry very firm. Abrupt; to-
B21	.30 to .70 m	Bright yellowish brown (2.5Y6/6) moist; common fine distinct grey mottles; medium heavy clay; strong; dry moderately strong; non-calcareous. Gradual; to-
D1	.70 to 1.05 m	Yellowish brown (2.5Y5/6) moist; few medium distinct grey mottles; sandy clay; massive; dry very weak; many manganiferous soft segregations, non-calcareous. Abrupt, to-
D2	1.05 to 1.10 m	Brownish grey (10YR6/1) moist; many medium distinct yellow mottles; medium heavy clay; dry; few manganiferous soft segregations, non-calcareous. Abrupt, to-
D3	1.10 to 1.20 m	Yellowish brown (2.5Y5/6) moist; few medium distinct grey mottles; sandy clay; massive; dry very weak; non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.10	5.6	.03	.001	14	53	17	14	7	1.7	1.7	.25	.09	.020	0.25	.021	1.5	19	7		
.20	5.8	.02	.001													1.3				
.30	6.3	.01	.001	13	50	14	21	7	1.0	2.2	.41	.04	.012	0.31	.009	1.7	17	8		
.60	6.6	.03	.002	7	44	11	35	18	3.9	10	2.0	.13	.005	0.72	.004	3.4	27	15		
.90	7.5	.10	.012	13	59	10	14	12	2.9	8.0	3.1	.04	.006	1.50	.003	2.3	15	8		
1.10	8.4	.15	.017	31	33	11	22	14	3.2	9.4	4.9	.07	.007	1.46	.004	2.9				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
.10	1.5	.10	3	9	.10				
.20	.77	.05	2	5	.04				

APPENDIX V (continued)

SOIL TYPE: Jumper
SITE NO: MCL 903
A.M.G. REFERENCE: 678 600 mE 7 696 100 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT: Aquic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few medium pebbles

SUBSTRATE MATERIAL: Sedimentary rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus alba; Tristania sauveolens; Eucalyptus intermedia; Melaleuca nervosa; Themeda australis; Heteropogon contortus

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .22 m	Brownish black (7.5YR3/1) moist; brownish grey (7.5YR6/1) dry; few fine distinct brown mottles; common fine distinct grey mottles; sandy clay loam; moderate 5-10mm subangular blocky; dry moderately weak. Clear; to-
A2	.22 to .35 m	Greyish yellow-brown (10YR4/2) moist; greyish yellow-brown (10YR6/2) dry; sandy clay loam; many rounded unspecified coarse fragments; moderate; dry moderately weak. Clear; to-
B21	.35 to .70 m	Bright yellowish brown (10YR6/6) moist; common medium distinct grey mottles; medium heavy clay; strong; moderately moist very firm; few manganiferous nodules; slightly calcareous. Diffuse; to-
B22	.70 to 1.00 m	Dull yellowish orange (10YR7/3) moist; many medium distinct gley mottles; sandy clay; weak; dry very firm; many carbonate soft segregations; moderately calcareous. Abrupt; to-
BC	1.00 to 1.20 m	Light grey (2.5Y8/1) moist; few fine distinct yellow mottles; light medium clay; moderate; dry very firm; many carbonate soft segregations; moderately calcareous.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
.10	5.9	.02	.001	13 54 23 10	6	2.7	1.8	.17	.09	.024	0.21	.018	1.5	21	7		
.20	5.8	.02	.001										1.4				
.30	6.1	.01	.001	18 48 20 14	6	.82	1.6	.28	.04	.023	0.26	.011	1.7	16	7		
.60	8.3	.10	.005	5 47 14 31	13	3.9	10	2.9	.09	.024	1.21	.008	2.8	24	13		
.90	9.8	.29	.020	1 59 18 20	15	5.3	10	4.9	.09	.005	2.02	.004	2.7	22	10		
1.20	9.6	.44	.035	4 51 21 24	16	6.1	14	7.3	.14	.005	1.91	.006	2.9				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K !m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
.10	1.9	.15	2	9	.10				
.20	.80	.04	2	9	.07				

SOIL TYPE: Silent Grove
SITE NO: MCL 904
A.M.G. REFERENCE: 674 400 mE 7 697 800 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.14
SOIL TAXONOMY UNIT: Udorthentic Chromustert
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few stones

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 09 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus tessellaris; Eucalyptus alba; Eucalyptus tereticornis; Tristania sauveolens; Albizia procera; Glochidian lobocardua

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking; self mulching

HORIZON	DEPTH	DESCRIPTION
A1	0 to .02 m	Black (10YR1.7/1) moist; brownish black (10YR3/2) dry; light clay; few angular andesite; strong 2-5mm granular; dry very firm. Clear; to-
B21	.02 to .55 m	Black (10YR1.7/1) moist; few fine faint yellow mottles; light medium clay; strong; moderately moist; few manganiferous nodules. Gradual; to-
B22	.55 to .80 m	Greyish yellow-brown (10YR4/2) moist; few fine distinct yellow mottles; light medium clay; few angular andesite; strong; moderately moist; few manganiferous nodules. Gradual; to-
B3	.80 to .86 m	Yellowish grey (2.5Y6/1) moist; few fine distinct yellow mottles; medium clay; few angular andesite; strong; moderately moist; few carbonate soft segregations; few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
.10	6.2	.06	.002	16 26 17 38	33	11	16	.28	.96	.075	0.31	.034	6.4	38	24		
.20	6.1	.02	.001										6.7				
.30	6.1	.02	.001	15 30 18 33	26	12	11	.22	.09	.070	0.23	.026	6.2	32	20		
.60	6.6	.02	.001	30 33 10 26	20	10	10	.40	.06	.048	0.26	.013	5.2	27	18		
.90	7.0	.02	.001	39 27 8 23	24	8.8	8.9	.43	.06	.045	0.31	.009	4.8	25	16		

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K !m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
.10	2.7	.20	10	24	1.0				
.20	2.0	.13	5	10	.22				

APPENDIX V (continued)

SOIL TYPE: Jumper
SITE NO: MCL S05
A.M.G. REFERENCE: 682 700 mE 7 690 600 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.32
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few medium pebbles

SUBSTRATE MATERIAL: Sedimentary rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating plains

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus crebra, Melaleuca viridiflora

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish grey (7.5YR4/1) moist; light brownish grey (7.5YR7/2) dry; sandy loam; many angular sedimentary rocks; moderate 2-5mm subangular blocky; dry very weak. Clear, to-
A2sb	.05 to .20 m	Brownish grey (7.5YR4/1) moist; few fine distinct brown mottles; sandy loam; many angular sedimentary rocks; dry very weak. Abrupt, to-
B21	.20 to .45 m	Dull yellowish orange (10YR6/4) moist; common fine faint yellow mottles; few fine distinct brown mottles; medium clay; few angular sedimentary rocks; moderate; dry very firm; slightly calcareous. Clear, to-
B22	.45 to .58 m	Greyish olive (5Y6/2) moist; common fine distinct yellow mottles; light medium clay; abundant angular sedimentary rocks; moderate; very weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.05	5.7	.03	.003	17	50	23	11	7	2.3	1.3	.22	.18	.024	0.28	.026	1.4	20	6		
.20	6.2	.03	.002													1.5				
.30	6.1	.20	.017	5	18	23	52	17	3.5	6.9	5.5	.16	.011	1.03	.013	3.9	38	22		
.58	7.9	.26	.026	17	21	33	31	14	4.3	6.4	8.3	.08	.012	1.94	.020	2.5	23	12		

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Extr. Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm	ppm	m.eq%	ppm			
.10	1.9	.16	5	7	.20				
.20	1.2	.12	2	6	.09				

SOIL TYPE: Wagoora; basic parent material variant
SITE NO: MCL S06
A.M.G. REFERENCE: 686 400 mE 7 692 500 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.11
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few stones

SUBSTRATE MATERIAL: Basalt
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus tereticornis; Eucalyptus crebra; Eucalyptus intermedia; Planchonia careya

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .20 m	Brownish black (7.5YR3/2) moist; dark brown (7.5YR3/3) dry; clay loam; strong; smooth-ped; dry very firm. Diffuse, to-
B21	.20 to .75 m	Reddish brown (5YR4/6) moist; medium clay; strong; smooth-ped; moderately moist; few manganiferous nodules; non-calcareous. Diffuse, to-
B22	.75 to 1.20 m	Reddish brown (5YR4/6) moist; common fine distinct yellow mottles; few fine distinct dark mottles; light clay; strong; smooth-ped; moderately moist; few manganiferous soft segregations; slightly calcareous. Gradual, to-
BC	1.20 to 1.50 m	Dull brown (7.5YR5/4) moist; medium clay; strong; smooth-ped; moderately moist; many manganiferous soft segregations; non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.10	6.0	.03	.002	26	20	25	28	16	8.5	4.6	.17	.12	.055	0.04	.032	4.3	27	17		
.20	6.0	.02	.001													4.3				
.30	6.1	.01	.001	17	17	17	48	13	7.6	4.6	.12	.02	.029	0.03	.018	4.6	37	21		
.60	6.2	.02	.001	9	11	17	62	21	10	7.8	.18	.02	.015	0.02	.010	5.9	41	26		
.90	6.2	.01	.001	5	20	22	52	31	16	13	.28	.02	.009	0.03	.006	7.5	45	29		
1.20	6.3	.01	.001	6	25	26	40	31	16	13	.28	.01	.008	0.03	.005	8.5				
1.50	6.6	.01	.001	4	27	26	40	38	22	16	.30	.01	.007	0.03	.004	8.0				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Extr. Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm	ppm	m.eq%	ppm			
.10	2.2	.14	2	8	.14				
.20	1.6	.11	2	5	.05				

APPENDIX V (continued)

SOIL TYPE: Wagoora
SITE NO: MCL 507
A.M.G. REFERENCE: 684 900 mE 7 685 900 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.52
SOIL TAXONOMY UNIT: Typic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 06 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus alba; Eucalyptus intermedia; Tristania sauveolens; Heteropogon contortus; Bothriochloa bladhii

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish brown (7.5YR5/2) dry; brownish black (7.5YR3/2) moist; clay loam; few rounded andesite; strong 5-10mm subangular blocky strong (2mm granular; smooth-ped; dry moderately strong. Diffuse; to-
A3	.15 to .25 m	Brownish black (7.5YR2/2) moist; few fine distinct grey mottles; light clay; many rounded andesite; strong; smooth-ped; dry moderately strong. Gradual; to-
B21	.25 to .45 m	Brown (7.5YR4/4) moist; medium clay; strong; smooth-ped; moderately moist moderately strong; slightly calcareous. Clear; to-
B22	.45 to .70 m	Yellowish brown (10YR5/6) moist; common fine distinct yellow mottles; medium clay; many angular andesite; strong; smooth-ped; moderately moist moderately strong; slightly calcareous. Gradual; to-
B23	.70 to 1.40 m	Brown (7.5YR4/3) moist; few medium faint yellow mottles; few fine faint dark mottles; medium clay; strong; smooth-ped; moderately moist moderately strong; few manganiferous nodules; slightly calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.10	6.0	.03	.001	19	29	23	28	19	6.8	5.3	.16	.31	.054	0.84	.027	3.7	32	17		
.25	6.0	.02	.001													3.3				
.35	6.3	.02	.001	15	19	15	48	18	4.4	7.0	.45	.16	.033	0.82	.018	4.3	35	22		
.60	6.9	.03	.003	10	22	16	49	19	5.5	11	1.2	.20	.019	0.91	.009	4.5	37	23		
.90	7.8	.05	.004	6	25	20	47	28	8.5	16	2.1	.18	.013	0.84	.006	4.9	38	22		
1.20	8.6	.14	.013	6	31	17	44	28	9.2	17	4.2	.17	.021	0.85	.005	4.7				
1.40	8.5	.20	.023	8	29	19	43	27	8.6	15	3.9	.10	.019	0.82	.004	5.8				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
.10	2.7	.14	4	8	.35				
.20	1.4	.10	2	5	.16				

SOIL TYPE: Calen
SITE NO: MCL 508
A.M.G. REFERENCE: 690 500 mE 7 684 800 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.42
SOIL TAXONOMY UNIT: Aquic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus intermedia; Tristania sauveolens; Eucalyptus tereticornis; Planchonia careya; Heteropogon contortus; Themeda australis

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .10 m	Yellowish grey (2.5Y4/1) moist; brownish grey (10YR6/1) dry; sandy clay loam; moderate 5-10mm subangular blocky; dry. Clear; to-
A12	.10 to .20 m	Greyish yellow-brown (10YR5/2) moist; sandy clay loam; massive; dry. Clear; to-
A2cb	.20 to .27 m	Light grey (10YR8/1) dry; sandy clay loam; massive; dry. Abrupt; irregular to-
B21	.27 to .70 m	Dark greyish yellow (2.5Y5/2) moist; common medium distinct yellow mottles; common medium distinct gley mottles; medium heavy clay; strong; moderately moist; non-calcareous. Clear; to-
B22	.70 to .90 m	Bright yellowish brown (2.5Y6/6) moist; many medium distinct grey mottles; medium clay; strong; moderately moist; non-calcareous. Gradual; to-
B23	.90 to 1.00 m	Bright yellowish brown (2.5Y6/6) moist; many medium distinct grey mottles; sandy clay; moderately moist; few manganiferous nodules; non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.10	5.9	.02	.001	24	42	21	12	6	2.0	1.1	.12	.13	.023	2.16	.015	1.0	21	7		
.20	6.0	.01	.001													1.0				
.27	6.4	.01	.001	23	40	23	12	5	1.6	1.0	.18	.05	.013	1.98	.005	1.0	19	7		
.60	6.9	.03	.002	17	33	20	31	12	4.0	4.0	1.1	.15	.015	1.96	.007	2.4	25	13		
.90	7.7	.03	.002	17	45	11	25	12	4.0	4.3	1.3	.15	.011	2.43	.003	2.1	24	12		

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
.10	1.2	.10	3	8	.16				
.20	.71	.06	2	4	.10				

APPENDIX V (continued)

SOIL TYPE: Victoria Plains
SITE NO: MCL S09
A.M.G. REFERENCE: 692 300 mE 7 687 400 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT: Udic Pellustert
FAO UNESCO UNIT:

TYPE OF MICRORELIEF: Normal gilgai
VERTICAL INTERVAL: 0.20 m
HORIZONTAL INTERVAL: 04 m
SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus alba, Eucalyptus tereticornis

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking, self mulching

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Black (10YR2/1) moist; brownish grey (10YR5/1) dry; light medium clay; strong 5-10mm angular blocky; dry; few carbonate nodules. Clear, to-
B21	.05 to .20 m	Black (10YR2/1) moist; light medium clay; dry; non-calcareous. Gradual, to-
B22	.20 to .50 m	Brownish black (7.5YR3/1) moist; few fine faint brown mottles; heavy clay; moderately moist; very few manganiferous nodules, non-calcareous. Gradual, to-
B23	.50 to .80 m	Brownish black (7.5YR3/1) moist; few fine faint brown mottles; heavy clay; moderately moist; very few carbonate nodules; non-calcareous; few manganiferous nodules. Diffuse, to-
B24	.80 to 1.10 m	Brownish grey (10YR4/1) moist; medium heavy clay; moist; few manganiferous nodules, slightly calcareous; few carbonate nodules, slightly calcareous. Gradual, to-
B25	1.10 to 1.20 m	Brownish grey (10YR4/1) moist; medium heavy clay; moist; few carbonate nodules, slightly calcareous; few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM 1/3b	15b	Disp.Ratio R1	R2
.05	6.5	.06	.004	8 20 29	43	31	21	6.5	.45	.43	.050	0.53	.021	4.6	41	21	
.20	6.1	.04	.002											5.1			
.30	6.1	.04	.003	2 17 24	57	28	15	6.6	.76	.22	.030	0.47	.016	4.8	40	20	
.60	6.2	.06	.006	5 20 26	50	33	17	7.6	1.5	.28	.019	0.48	.010	5.0	44	23	
.90	7.4	.15	.018	2 12 20	66	41	29	13	3.1	.32	.016	0.56	.008	7.0	51	28	
1.20	8.5	.31	.029	2 13 19	69	44	33	13	3.9	.31	.020	0.63	.004	7.1			

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb.	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
.5	2.1	.13	20	34	.45				
.20	2.0	.12	8	10	.20				

SOIL TYPE: Narpi
SITE NO: MCL S10
A.M.G. REFERENCE: 693 100 mE 7 679 200 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .01 m	Greyish yellow-brown (10YR4/2) moist, brownish grey (10YR5/1) dry; few fine distinct brown mottles; clay loam,fine sandy; moderate; dry. Abrupt, to-
A2eb	.01 to .15 m	Greyish yellow-brown (10YR4/2) moist; few fine distinct brown mottles; clay loam,fine sandy; moderate; dry; very few manganiferous nodules. Clear, to-
B1eb	.15 to .20 m	Dull yellowish brown (10YR5/3) moist; light clay; moderately moist; very few manganiferous nodules. Abrupt, to-
B21	.20 to .50 m	Dull yellowish orange (10YR6/4) moist; few medium faint yellow mottles; heavy clay; moderately moist; few manganiferous nodules. Clear, to-
B22	.50 to .70 m	Dull yellowish brown (10YR5/3) moist; few medium faint yellow mottles; heavy clay; moderately moist; few manganiferous nodules.
B23	.70 to .90 m	Dull yellowish orange (10YR6/3) moist; few medium distinct yellow mottles; medium clay; moderately moist; very few manganiferous nodules.
B24	.90 to 1.15 m	Dull yellowish orange (10YR6/3) moist; medium clay; moderately moist.
D1	1.15 to 1.20 m	Brownish grey (10YR5/1) moist; medium clay; moderately moist; very few carbonate soft segregations, very few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM 1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.5	.03	.003			18	4.4	2.9	0.1	.34	.026	.58	.021				
.10	5.8	.02	.002	15 22 32	35	18	3.8	2.7	0.2	.20	.024	.57	.014	3.1	31	14	.67 .23
.20	5.8	.02	.002														
.30	5.9	.02	.002	6 14 21	61	30	9.0	5.9	0.9	.27	.015	.58	.009	5.8	37	22	.69 .34
.60	6.5	.10	.016	10 18 18	53	32	16	10	1.8	.08	.014	.57	.006	6.0	36	21	.83 .44
.90	7.9	.19	.029	17 36 15	33	24	14	9.2	2.2	.06	.017	.98	.004	4.3	29	16	.92 .51
1.20	8.0	.38	.056	3 17 29	50	33	19	13	3.6	.10	.016	1.07	.003	6.3			

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb.	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.8	.17	7	13	.29	172	126	1.7	1.9
.10	.98	.09	4	8	.17				
.20	.59	.07	3	4	.16				

APPENDIX V (continued)

SOIL TYPE: St. Helens
SITE NO: MCL S11
A.M.G. REFERENCE: 685 700 mE 7 688 800 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.41
SOIL TAXONOMY UNIT: Entic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 0 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Terrace

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Black (10YR2/1) moist; brownish grey (10YR5/1) dry; sandy clay loam; earthy; moderately moist moderately firm. Gradual, to-
B21	.25 to .80 m	Black (10YR2/1) moist; light clay; few angular quartz; moderate; moderately moist moderately weak. Clear, to-
D1	.80 to .95 m	Brown (7.5YR4/4) moist; few fine faint dark mottles; sandy clay loam; moderately moist very weak. Clear, to-
D2	.95 to 1.00 m	Dark brown (7.5YR3/4) moist; sandy loam; moderately moist loose. Clear, to-
D3	1.00 to 1.10 m	Dark brown (7.5YR3/4) moist; sandy loam; abundant rounded unspecified coarse fragments; moderately moist loose.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.3	.04	.004					16	2.3	1.2	.1	.41	.056	1.66	.014					
.10	5.3	.06	.007	32	32	20	20	15	1.9	0.9	.1	.37	.051	1.68	.013	1.9	20	10	.72	.30
.20	5.2	.03	.003	26	36	20	22	16	1.9	0.8	.1	.23	.043	1.70	.014	2.0	20	9	.67	
.40	5.5	.01	.001																	
.60	5.7	.01	.001	24	35	15	27	17	2.5	0.7	.1	.10	.030	1.80	.011	2.3	20	12	.67	.21
.90	5.9	.01	.001	36	33	10	20	12	2.8	1.1	.1	.08	.029	1.90	.007	1.8	17	9	.71	.21
1.10	5.7	.01	.001																	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Extr. Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm	ppm	m.eq%	ppm			
Bulk .10	1.4	.08	88	74	.36	94	30	.90	2.1
.10	1.4	.07	83	69	.44				
.20	1.4	.08	48	54	.25				

SOIL TYPE: Pindi
SITE NO: MCL S12
A.M.G. REFERENCE: 681 800 mE 7 693 400 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy2.31
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few medium pebbles

SUBSTRATE MATERIAL: Sedimentary rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus tereticornis; Eucalyptus intermedia, Eucalyptus alba; Tristania sauveolens

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .02 m	Brownish grey (10YR5/1) moist; greyish yellow-brown (10YR6/2) dry; sandy clay loam; dry. Abrupt, to-
A2sb	.02 to .25 m	Brownish grey (10YR5/1) moist; sandy clay loam; many rounded unspecified coarse fragments; dry. Abrupt, to-
A3	.25 to .32 m	Dull yellowish brown (10YR5/3) moist; sandy clay loam; abundant rounded unspecified coarse fragments; dry. Abrupt, to-
B21	.32 to .55 m	Bright yellowish brown (10YR6/6) moist; few fine distinct red mottles; medium heavy clay; few rounded unspecified coarse fragments; moderately moist moderately firm. Gradual, to-
B22	.55 to .95 m	Bright yellowish brown (10YR6/6) moist; common fine distinct red mottles; common medium distinct pale mottles; medium heavy clay; few rounded unspecified coarse fragments; moderately moist moderately firm. Gradual, to-
B23	.95 tb 1.20 m	Bright brown (2.5YR5/8) moist; many medium distinct pale mottles; heavy clay; moderately moist very firm. Abrupt, to-
B3	1.20 to 9.99 m	Bright yellowish brown (10YR7/6) moist; common coarse prominent grey mottles; medium clay; moderately moist moderately firm.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
.10	5.5	.02	.002	29	50	10	14	9	0.8	1.3	.05	.10				1.0	14	4	.47	
.20	5.5	.01	.001	21	48	9	15	7			.05					1.2				
.32	5.6	.01	.001	25	42	10	25	8	.05	1.1	.05	.03				1.8	15	7	.50	
.55	5.7	.02	.002	15	18	5	64	20	0.3	3.2	1.0	.05				5.4	34	22	.42	
.90	5.5	.06	.008	18	15	10	60	24	.05	4.6	2.2	.10				5.2	35	21	.62	
1.20	5.5	.11	.017	30	17	13	43	23	.03	5.5	3.6					4.3	31	17	.87	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus Acid	Extr. Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm	ppm	m.eq%	ppm			
.10			13	6	.11				
.20	0.5								

APPENDIX V (continued)

SOIL TYPE: Cameron
SITE NO: MCL S13
A.M.G. REFERENCE: 687 600 mE 7 690 600 mN ZONE 55

GREAT SOIL GROUP: Alluvial soil
PRINCIPAL PROFILE FORM: Um1.43
SOIL TAXONOMY UNIT: Typic Ustorthent
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 0 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Flood-plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .40 m	Brown (10YR4/4) moist, dull yellowish orange (10YR6/3) dry; sandy clay loam; earthy; moderately moist. Clear; to-
D1	.40 to .50 m	Brown (10YR4/4) moist; fine sandy loam; earthy; moderately moist. Abrupt; to-
D2	.50 to 1.20 m	Dull yellowish brown (10YR5/4) moist; sand; sandy; moderately moist.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K %	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
							m.eq/100g								% @ 105C				
Bulk .10	5.2	.07	.002				14	5.0	1.5	.1	.25	.053	1.74	.016					
.10	5.3	.07	.002	14	46	23 20	14	5.2	1.5	.1	.27	.054	1.76	.017	2.0	22	10	.73	.22
.20	5.3	.05	.001																
.30	5.5	.03	.001	12	48	23 20	14	5.5	1.4	.1	.18	.053	1.71	.015	2.1	22	10	.80	.22
.50	5.8	.02	.001	27	45	12 19	10	5.9	1.3	.1	.13				1.9	16	8	.68	
.90	5.7	.01	.001	78	16	3 3	4	1.8	0.3	.1	.03	.025	1.72	.005	0.6	5	3	.10	.12
1.20	6.0	.01	.001	69	24	1 6	4	2.3	0.7	.1	.03	.025	1.94	.006	0.7				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.86	.07	49	35	.29	62	38	1.8	1.9
.10	.73	.09	65	31	.30				
.20	.81	.09	50	34	.29				

SOIL TYPE: Seaforth
SITE NO: MCL S14
A.M.G. REFERENCE: 705 400 mE 7 677 300 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish yellow-brown (10YR5/2) moist; clay loam;fine sandy; moderately moist. Clear; to-
A2	.15 to .40 m	Greyish yellow-brown (10YR6/2) moist; few medium faint brown mottles; loam; fine sandy; moderately moist. Clear; to-
B21	.40 to .70 m	Dull yellowish brown (10YR5/3) moist; common medium distinct brown mottles; few fine distinct yellow mottles; light medium clay; moderately moist moderately weak. Gradual; to-
B22	.70 to 1.05 m	Yellowish brown (2.5Y5/6) moist; many coarse distinct grey mottles; medium clay; few subangular quartz; few rounded unspecified coarse fragments; moderately moist moderately weak; few manganiferous nodules. Clear; to-
D	1.05 to 1.20 m	Dull yellowish brown (10YR4/3) moist; common medium distinct yellow mottles; sandy clay; few subangular quartz; moderate; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K %	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
							m.eq/100g								% @ 105C				
Bulk .10	5.4	.03	.003				8	1.6	1.0	.1	.17	.015	.79	.016					
.10	5.5	.04	.003	19	30	34 20	9	1.8	1.4	.1	.17	.017	.79	.019	1.3	27	8	.71	.20
.15	5.5	.03	.002																
.30	6.0	.02	.001	21	37	24 19	6	1.9	1.0	.1	.05	.009	.76	.008	1.1	20	7	.84	.26
.60	6.1	.02	.001	19	28	17 36	14	3.5	4.7	0.3	.05	.008	.98	.007	2.5	25	15	.80	.34
.90	6.2	.03	.004	25	28	13 32	15	3.2	6.7	0.4	.05	.005	1.20	.005	2.4	24	14	.88	.41
1.20	6.8	.06	.009	41	28	8 22	12	2.7	6.1	0.6	.05	.010	1.32	.003	1.9				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.1	.12	5	10	.20	156	22	0.4	1.7
.10	1.5	.14	10	15	.16				
.20	.87	.12	5	10	.10				

APPENDIX V (continued)

SOIL TYPE: Belmunda
SITE NO: MCL S15
A.M.G. REFERENCE: 706 400 mE 7 680 600 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Db2.31
SOIL TAXONOMY UNIT: Paleustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .10 m	Brownish black (10YR3/1) moist; sandy clay loam; dry; few manganiferous nodules. Clear; to-
A12	.10 to .35 m	Brownish black (10YR3/1) moist; sandy clay loam; dry; many manganiferous nodules. Gradual; to-
A2sb	.35 to .45 m	Brownish grey (10YR4/1) moist; sandy clay loam; moderately moist; many manganiferous nodules. Clear; to-
B1sb	.45 to .60 m	Dull yellowish brown (10YR5/3) moist; few fine distinct red mottles; sandy clay; moderately moist; many manganiferous soft segregations; many manganiferous nodules. Gradual; to-
B22	.60 to 1.00 m	Brown (10YR4/4) moist; few fine prominent red mottles; sandy clay; moderately moist; many manganiferous soft segregations; many manganiferous nodules. Clear; to-
B23	1.00 to 1.20 m	Bright brown (7.5YR5/6) moist; few medium distinct grey mottles; medium clay; moderately moist very firm; many manganiferous soft segregations; many manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS %	S %	C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.5	.15	.007				17	2.1	2.0	.1	.93	.078	.22	.032					
.10	5.7	.14	.008	45	25	18 14	17	2.5	2.0	.1	.55	.078	.22	.034	2.3	24	12	.69	.14
.20	5.8	.06	.003																
.30	5.9	.03	.002	44	26	16 15	12	2.1	.2	.1	.21	.069	.11	.018	2.1	21	11	.70	.11
.60	6.1	.03	.003	37	30	18 16	7	0.6	1.4	.1	.05	.061	.12	.008	1.7	19	10	.81	.24
.90	6.0	.02	.002	43	27	16 16	9	0.8	1.2	.1	.11	.054	.09	.010	2.0	19	10	.75	.26
1.20	6.4	.07	.011	30	20	13 37	13	1.4	6.4	0.8	.03	.044	.17	.006	3.2				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.8	.14	13	15	.96	124	94	6.9	6.6
.10	2.2	.20	8	22	.58				
.20	1.2	.12	5	14	.19				

SOIL TYPE: Wagoora; basic parent material variant
SITE NO: MCL S16
A.M.G. REFERENCE: 696 500 mE 7 686 400 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Uf6.41
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Basalt
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .20 m	Brownish black (10YR2/2) moist; light clay; moderately moist; very few manganiferous nodules. Clear; to-
B21	.20 to .30 m	Brown (7.5YR4/4) moist; medium clay; moderately moist; few manganiferous nodules. Clear; to-
B22	.30 to .60 m	Brown (7.5YR4/6) moist; common fine distinct yellow mottles; light medium clay; few subangular basalt; moderately moist; few manganiferous nodules. Diffuse; to-
B3	.60 to 1.10 m	Brown (7.5YR4/6) moist; common fine distinct yellow mottles; light clay; few subangular basalt; moderately moist; few manganiferous soft segregations; few manganiferous nodules. Diffuse; to-
BC	1.10 to 1.20 m	Brown (7.5YR4/6) moist; common fine distinct yellow mottles; light clay; few subangular basalt; moderately moist; few manganiferous soft segregations; few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS %	S %	C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.7	.04	.003				38	9.4	6.7	0.1	.31	.049	.08	.030					
.10	5.8	.03	.002	19	23	19 41	35	9.0	5.9	0.2	.10	.041	.07	.026	5.1	32	21	.42	.15
.20	5.8	.02	.001																
.30	6.1	.02	.002	7	15	19 63	38	11	8.0	0.3	.05	.022	.05	.020	6.2	44	30	.38	.20
.55	6.6	.02	.001	13	27	25 40	39	14	11	0.4	.03				7.2	43	24	.50	
.90	6.8	.02	.001	23	36	25 15	39	18	15	0.5	.03	.009	.04	.004	6.5	38	21	.63	.22
1.20	7.0	.02	.001	34	31	21 11	42	25	18	0.5	.03	.015	.04	.003	6.8				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	3.0	.18	4	11	.31	100	102	6.4	3.2
.10	2.2	.17	3	8	.10				
.20	2.1	.15	2	6	.06				

APPENDIX V (continued)

SOIL TYPE: Ossa
SITE NO: MCL S17
A.M.G. REFERENCE: 696 200 mE 7 679 300 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.42
SOIL TAXONOMY UNIT: Aquic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Tristania sauveolens, Eucalyptus alba

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish yellow-brown (10YR4/2) moist; loam, fine sandy; dry. Abrupt, to-
A2eb	.15 to .40 m	Greyish yellow-brown (10YR6/2) moist; loam, fine sandy; dry. Clear, to-
B1	.40 to .55 m	Dull yellowish orange (10YR6/3) moist; common medium distinct yellow mottles; common medium distinct grey mottles; light medium clay; few subangular unspecified coarse fragments; few subangular quartz; moderately moist very firm. Abrupt; to-
B21	.55 to 1.10 m	Yellowish brown (10YR5/8) moist, greyish yellow-brown (10YR6/2) moist; medium heavy clay; moderately moist moderately strong; very few manganiferous soft segregations. Clear, to-
(D)	1.10 to 1.20 m	Greyish yellow-brown (10YR6/2) moist; few fine distinct yellow mottles; light medium clay; few subangular unspecified coarse fragments; moderately moist moderately strong; very few manganiferous soft segregations.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM 1/3b % @ 105C	15b	Disp.Ratio R1	R2
							m.eq/100g											
Bulk .10	5.3	.03	.003				9	1.4	0.9	.1	.14	.015	.35	.012				
.10	5.4	.03	.002	9	65	17 12	6	1.1	0.4	.1	.11	.013	.33	.011	0.9	16 5	.48	.11
.15	5.6	.02	.002															
.30	6.0	.01	.001	6	69	16 11	3	0.8	0.2	.1	.03	.009	.36	.005	0.5	12 3	.72	.28
.50	5.9	.03	.003	6	54	15 26	11	2.5	1.5	6.5	.11				1.8	20 10	.79	
.90	6.5	.12	.017	5	43	14 41	17	6.7	3.6	2.1	.05	.010	1.07	.005	2.7	27 14	.88	.65
1.20	7.4	.17	.023	9	47	17 31	15	6.6	3.1	2.4	.05	.010	1.27	.003	2.2			

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.1	.10	4	6	.15	64	46	0.1	2.9
.10	1.0	.09	4	4	.12				
.20	.61	.05	6	6	.08				

SOIL TYPE: Mulei
SITE NO: MCL S18
A.M.G. REFERENCE: 700 700 mE 7 668 200 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Gn2.74
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Sandstone
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus intermedia, Tristania sauveolens, Xanthorrhoea sp.

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .07 m	Greyish brown (7.5YR4/2) moist; sandy loam; massive; moderately moist. Gradual, to-
A2	.07 to .35 m	Dull yellowish orange (10YR6/4) moist; light sandy clay loam; massive; moderately moist. Gradual, to
B21	.35 to .60 m	Bright yellowish brown (10YR6/6) moist; sandy clay loam; few rounded quartz; massive; moderately moist very weak. Gradual, to-
B22	.60 to .75 m	Bright yellowish brown (10YR6/6) moist; few medium prominent red mottles; sandy clay; few rounded quartz; massive; moderately moist very weak. Gradual, to-
B23	.75 to 1.20 m	Bright yellowish brown (10YR6/6) moist; common medium prominent red mottles; sandy clay; few rounded quartz; massive; moderately moist very weak.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM 1/3b % @ 105C	15b	Disp.Ratio R1	R2
							m.eq/100g											
Bulk .07	5.5	.02	.001				9	0.3	0.7	.1	.13	.016	.20	.012				
.07	5.2	.02	.002	20	66	6 9	6	0.1	0.5	.1	.08	.013	.20	.009	0.8	10 4	.45	.08
.20	5.2	.01	.001															
.30	5.1	.01	.001	17	66	7 13	5	.1	0.3	.1	.03	.010	.18	.005	0.8	10 5	.48	.08
.60	5.3	.01	.001	15	63	5 17	5	0.3	0.9	.1	.03	.013	.23	.006	1.0	10 6	.33	0
.90	5.4	.02	.002	14	47	6 34	9	.1	1.4	.1	.04	.016	.46	.011	1.9	18 12	.07	0
1.20	5.3	.02	.002	11	49	6 39	9	021	1.6	.1	.04	.015	.50	.010	2.1			

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.1	.07	8	5	.12	54	10	0.1	1.1
.10	.87	.06	3	5	.09				
.20	.39	.03	2	2	.03				

APPENDIX V (continued)

SOIL TYPE: Kuttabul
SITE NO: MCL S19
A.M.G. REFERENCE: 698 300 mE 7 668 800 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy2.31
SOIL TAXONOMY UNIT: Paleustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Sandstone
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 06 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus intermedia, Tristania sauveolens, Xanthorrhoea sp.

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .07 m	Greyish brown (7.5YR4/2) moist; light sandy clay loam; moderately moist. Abrupt; to-
A12	.07 to .15 m	Greyish yellow-brown (10YR4/2) moist; sandy clay loam; moderately moist. Abrupt; to-
A2	.15 to .20 m	Dull yellowish brown (10YR5/3) moist; sandy clay loam; dry. Abrupt; to-
B1	.20 to .40 m	Dull yellowish brown (10YR5/4) moist, dull yellowish brown (10YR5/3) moist; sandy clay; dry very firm. Clear, to-
B21	.40 to .75 m	Bright reddish brown (5YR5/6) moist, bright brown (7.5YR5/6) moist; medium clay; moderately moist very firm. Diffuse, to-
B22	.75 to 1.05 m	Bright yellowish brown (10YR6/6) moist; many medium distinct red mottles; medium clay; moderately moist very firm; few manganiferous soft segregations, few manganiferous nodules. Clear, to-
B23	1.05 to 1.20 m	Bright yellowish brown (10YR6/6) moist; many medium distinct pale mottles; medium clay; few rounded unspecified coarse fragments; moderately moist moderately firm; few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS	FS	S	C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .07	5.8	.03	.002					12	2.4	1.5	.1	.26	.024	.35	.018					
.07	5.6	.02	.002	13	65	10	14	10	2.1	1.3	.1	.15	.022	.28	.014	1.3	16	7	.50	.12
.20	5.4	.01	.001																	
.30	5.4	.01	.001	9	61	12	19	10	0.9	0.9	.1	.08	.020	.32	.011	1.6	16	8	.51	.19
.60	5.7	.01	.002	9	31	14	48	20	0.9	0.7	0.3	.10	.034	.55	.019	3.4	31	21	.27	.08
.90	6.0	.02	.003	14	29	17	39	22	2.9	1.2	0.5	.08	.032	.48	.011	3.7	32	20	.30	.07
1.20	6.2	.02	.002	12	27	27	35	23	7.4	2.9	0.7	.10	.032	.38	.006	3.7				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.6	.11	6	9	.30	76	20	0.3	1.0
.10	.78	.10	3	7	.17				
.20	.79	.06	2	5	.08				

SOIL TYPE: Royston
SITE NO: MCL S20
A.M.G. REFERENCE: 690 900 mE 7 671 000 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Uf6.31
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 06 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Black (10YR1.7/1) moist; light medium clay; moderately moist. Gradual; to-
B21	.15 to .25 m	Black (10YR2/1) moist; few fine faint brown mottles; medium heavy clay; moderately moist very firm. Clear, to-
B22	.25 to .85 m	Brown (7.5YR4/4) moist; few fine distinct dark mottles, few fine faint yellow mottles; medium heavy clay; moderately moist very firm; very few manganiferous nodules. Gradual, to-
B3	.85 to 1.20 m	Brown (7.5YR4/3) moist; light clay; dry moderately firm; very few manganiferous nodules, very few manganiferous soft segregations.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS	FS	S	C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .10	5.9	.06	.002					48	13	7.5	.1	1.2	.052	.39	.044					
.10	5.8	.05	.002	12	16	25	44	49	13	7.9	.1	.85	.115	.34	.042	5.5	42	25	.41	.18
.25	5.8	.03	.002																	
.35	5.7	.04	.002	6	11	21	61	43	11	9.1	0.2	.19	.048	.18	.024	7.4	45	29	.40	.23
.60	6.1	.03	.002	3	17	27	54	41	11	11	0.3	.13	.026	.23	.015	7.4	44	28	.46	.06
.90	7.0	.03	.001	4	26	30	40	44	16	15	0.4	.10	.022	.30	.010	6.4	41	25	.46	.19
1.20	6.8	.02	.001	4	41	29	26	50	21	15	0.4	.09	.059	.28	.008	6.7				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.9	.29	71	97	1.1	160	130	3.9	4.1
.10	3.7	.28	67	80	.78				
.20	2.8	.19	15	22	.25				

APPENDIX V (continued)

SOIL TYPE: Andergrove
SITE NO: MCL S21
A.M.G. REFERENCE: 723 500 mE 7 673 900 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: iuC.221
SOIL TAXONOMY UNIT: Typic Ustipsamment
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Sand
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE: Dune
LANDFORM PATTERN TYPE:

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
AP1	0 to .30 m	Brownish black (10YR3/2) moist; greyish yellow-brown (10YR4/2) dry; loamy sand; sandy; dry loose. Abrupt; to-
AP2	.30 to .45 m	Greyish yellow-brown (10YR4/2) moist; brownish grey (10YR6/1) dry; loamy sand; sandy; moderately moist loose. Gradual; to-
A2cb	.45 to .90 m	Dull yellowish brown (10YR5/3) moist; dull yellowish orange (10YR7/2) dry; sand; sandy; moderately moist loose. Diffuse; to-
B21	.90 to 1.20 m	Dull yellowish orange (10YR6/3) moist; light yellowish orange (10YR8/3) dry; sand; sandy; moderately moist loose.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS %	S	C @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.6	.02	.002									.031	1.59	.012					
.10	5.6	.02	.001	30	62	3 6	5	.25	.11	.10	.13	.031	1.58	.012	0.8	7	3	.24	
.20	5.5	.01	.001												0.9				
.30	5.5	.01	.001	34	58	3 9	5	.10	.05	.10	.11	.023	1.58	.011	0.9	7	3	.02	
.60	5.5	.01	.001	37	59	1 6	2	.08	.05	.10	.08	.016	1.60	.010	0.7	5	3	.05	
.90	5.8	.01	.001	42	53	1 6	2	.39	.06	.10	.08	.012	1.60	.007	0.4	5	2	.05	
1.20	5.9	.01	.001	40	55	1 6	2	.52	.10	.10	.12	.010	1.63	.006	0.5				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.66	.05	102	28	.16	18	4	0.2	0.2
.10	.80	.06	83	24	.14				
.20	.76	.06	80	21	.12				

SOIL TYPE: Neils
SITE NO: MCL S22
A.M.G. REFERENCE: 718 300 mE 7 676 400 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy5.81
SOIL TAXONOMY UNIT: Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Sand
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE: Dune
LANDFORM PATTERN TYPE:

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish grey (7.5YR4/1) moist; brownish grey (7.5YR5/1) dry; loamy sand; sandy; moderately moist loose. Clear; to-
A2cb	.15 to .50 m	Greyish brown (7.5YR6/2) moist; light grey (10YR7/1) dry; loamy sand; sandy; moderately moist loose. Abrupt; to-
A22cb	.50 to .58 m	Greyish yellow-brown (10YR6/2) moist; loamy sand; sandy; moderately moist loose; many ferruginous concretions. Abrupt; to-
B21	.58 to .90 m	Dull yellow (2.5Y6/4) moist; few medium distinct grey mottles; few fine distinct yellow mottles; sandy clay; moderate; smooth-ped; moist very weak; few ferruginous concretions. Diffuse; to-
B22	.90 to 1.20 m	Greyish yellow (2.5Y7/2) moist; few fine distinct yellow mottles; sandy clay; weak; smooth-ped; wet very weak; few ferruginous concretions.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS %	S	C @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.9	.02	.001									.014	0.50	.015					
.10	6.1	.03	.002	16	76	6 6	5	2.1	.72	.10	.13	.017	0.57	.018	0.8	10	5	.12	
.15	6.0	.02	.002												0.6				
.30	6.4	.01	.001	14	80	3 6	1	.62	.20	.10	.05	.005	0.43	.003	0.2	3	1	.39	
.58	6.5	.01	.001	14	69	4 16	2	.97	.25	.10	.09	.006	0.56	.005	0.5	8	4	.43	
.90	7.4	.02	.001	15	58	4 27	5	1.5	1.4	.10	.19	.010	0.58	.008	1.3	15	9	.02	
1.20	6.8	.02	.001	14	60	5 22	4	.81	1.8	.10	.20	.010	0.58	.009	1.2				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.90	.08	10	8	.11	82	32	0.2	1.0
.10	.82	.09	17	9	.14				
.20	.76	.05	10	8	.11				

APPENDIX V (continued)

SOIL TYPE: Habana
SITE NO: MCL S23
A.M.G. REFERENCE: 714 900 mE 7 675 400 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Uf6.4
SOIL TAXONOMY UNIT: Typic Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Igneous rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 06 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Brownish black (10YR3/2) moist; brownish grey (10YR6/1) dry; light clay; few angular igneous rocks; weak; moderately moist moderately weak. Clear; to-
B1	.25 to .40 m	Light medium clay; abundant angular igneous rocks; moderate; moderately moist. Clear; to-
B21	.40 to .55 m	Bright yellowish brown (10YR6/6) moist; few fine distinct yellow mottles; few fine distinct red mottles; medium clay; moderate; moderately moist very firm; few manganiferous nodules. Clear; to-
B22	.55 to .95 m	Greyish yellow-brown (10YR6/2) moist; common fine distinct yellow mottles; medium clay; weak; moderately moist moderately firm; few manganiferous nodules. Clear; to-
BC	.95 to 1.10 m	Greyish yellow-brown (10YR6/2) moist; few fine distinct grey mottles; few fine distinct yellow mottles; light clay; moderately moist moderately weak.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC Ca Mg Na K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM 1/3b 15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.7	.03	.003			.034	0.30	.019			
.10	5.6	.04	.004	25 18 23 34	16 2.6 1.9 .10 .40	.033	0.32	.017	2.7 26 13	.74	
.20	5.4	.02	.002						2.9		
.35	5.7	.02	.001	25 14 18 45	16 3.7 1.9 .10 .12	.020	0.58	.020	3.3 27 16	.59	
.55	5.9	.02	.002		16 5.1 3.7 .20 .11	.014	0.70	.015	4.6		
.90	6.5	.02	.001	14 21 32 37	15 5.4 4.0 .45 .08	.009	0.72	.007	2.8 31 14	.75	
1.10	6.8	.01	.001		10 6.0 3.9 .50 .04	.009	0.74	.004			

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid ppm	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.4	.11	34	16	.33	59	200	1.3	0.9
.10	1.3	.09	36	16	.40				
.20	1.1	.08	13	13	.24				

SOIL TYPE: Etowrie
SITE NO: MCL S24
A.M.G. REFERENCE: 717 700 mE 7 670 900 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Uf6.41
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Greyish yellow-brown (10YR4/2) moist; greyish yellow-brown (10YR6/2) dry; light medium clay; moderate; moderately moist very firm. Clear; to-
B21	.25 to .50 m	Dull yellowish brown (10YR5/4) moist; many fine distinct grey mottles; heavy clay; strong; moist moderately firm; few manganiferous nodules. Gradual; to-
B22	.50 to 1.00 m	Brownish black (10YR3/1) moist; medium heavy clay; strong; moist moderately firm; few manganiferous nodules. Gradual; to-
B23	1.00 to 1.20 m	Dark greyish yellow (2.5Y5/2) moist; few fine distinct yellow mottles; heavy clay; few angular unspecified coarse fragments; moderate; moist moderately firm; few carbonate nodules; few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC Ca Mg Na K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM 1/3b 15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	6.2	.04	.003			.040	0.44	.020			
.10	6.2	.02	.002	7 33 30 34	18 5.9 5.4 .25 .23	.038	0.43	.015	3.2 28 13	.64	
.20	6.1	.03	.003						3.6		
.35	6.4	.11	.013	3 19 19 62	32 12. 12. 1.8 .13	.015	0.40	.013	6.2 42 23	.67	
.60	7.1	.30	.048	2 12 27 62	36 18. 21. 4.4 .07	.012	0.43	.009	7.2 45 24	.80	
.90	7.7	.48	.076	3 19 26 55	36 14. 18. 5.3 .07	.013	0.44	.009	6.2 39 21	.92	
1.20	8.2	.48	.072	4 22 24 56	33 13. 16. 5.6 .06	.012	0.43	.005	6.2		

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid ppm	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.2	.11	40	35	.35	114	75	2.0	1.7
.10	.96	.09	40	31	.19				
.20	.86	.07	35	30	.09				

APPENDIX V (continued)

SOIL TYPE: Glenella
SITE NO: MCL S25
A.M.G. REFERENCE: 723 400 mE 7 664 300 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Uf6.31
SOIL TAXONOMY UNIT: Typic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Diorite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Black (7.5YR2/1) moist; greyish brown (7.5YR4/2) dry; light clay; few angular diorite; moderate; moderately moist moderately firm. Clear; to-
B21	.25 to .50 m	Brown (7.5YR4/4) moist; few fine distinct red mottles; heavy clay; few angular diorite; strong; no cutans clay skins; moderately moist moderately firm; few manganiferous nodules. Gradual; to-
B22	.50 to .90 m	Dull yellowish brown (10YR5/4) moist; medium clay; strong; moderately moist moderately firm; few manganiferous nodules. Diffuse; to-
B3	.90 to 1.20 m	Dark greyish yellow (2.5Y4/2) moist; common fine distinct grey mottles; light clay; weak; moderately moist moderately weak; few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P %	K	S	Moistures ADM 1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .10	5.8	.02	.002									.054	0.28	.020				
.10	5.8	.02	.001	24	44	8	26	19	3.2	2.9	.20	.30	.050	0.28	.020	2.7	19	10	.56	
.20	5.7	.02	.001													3.0				
.40	5.9	.03	.003					27	7.4	5.5	.25	.13	.038	0.17	.028	7.2				
.60	6.5	.03	.003	5	20	24	54	28	11.	8.9	.45	.11	.026	0.22	.020	6.6	44	26	.48	
.90	6.7	.02	.003	6	35	28	35	28	15.	13.	.50	.05	.023	0.36	.011	6.2	39	22	.65	
1.20	7.1	.03	.003	20	41	24	18	21	17.	13.	.45	.03	.074	0.46	.006	5.2				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn
Bulk .10	1.0	.09	21	22	.24	126	101	1.9	1.2
.10	1.5	.09	22	21	.29				
.20	1.1	.08	20	19	.19				

SOIL TYPE: Farleigh
SITE NO: MCL S26
A.M.G. REFERENCE: 717 200 mE 7 664 900 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Dy2.12
SOIL TAXONOMY UNIT: Typic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few gravel

SUBSTRATE MATERIAL: Granodiorite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Brownish black (10YR3/1) moist; brownish grey (10YR5/1) dry; light sandy clay loam; earthy; dry moderately weak. Abrupt; to-
B21	.25 to .45 m	Dull yellowish brown (10YR5/4) moist; few fine distinct yellow mottles; medium clay; many subangular quartz; strong; smooth-ped; moderately moist moderately firm. Gradual; to-
B3	.45 to .80 m	Bright yellowish brown (10YR6/6) moist; light yellowish orange (10YR8/3) moist; common medium distinct grey mottles; light medium clay; weak; moderately moist moderately weak. Diffuse; to-
C	.80 to 1.20 m	Dull yellowish orange (10YR6/3) moist; many coarse distinct yellow mottles; clayey coarse sand; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS	FS	S	C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P %	K	S	Moistures ADM 1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .10	5.6	.02	.001										.042	0.95	.011				
.10	5.7	.02	.001	53	27	6	17	9	1.6	1.3	.10	.23	.061	1.05	.012	1.4	12	6	.64	
.20	5.4	.02	.001													1.5				
.35	5.4	.03	.001	37	13	7	45	15	4.3	2.0	.10	.13	.023	1.21	.023	4.2	27	17	.56	
.60	6.1	.02	.001	40	18	10	34	14	5.5	4.4	.20	.10	.020	1.73	.014	4.2	28	16	.67	
.90	6.3	.02	.001	45	24	12	22	12	5.3	5.4	.20	.08	.020	2.51	.009	2.9	20	11	.63	
1.20	6.7	.02	.001	52	25	8	16	12	2.7	6.8	.20	.04	.036	2.09	.006	3.2				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn
Bulk .10	.78	.05	150	73	.30	175	21	1.1	1.6
.10	.60	.05	111	87	.28				
.20	.80	.06	130	88	.20				

APPENDIX V (continued)

SOIL TYPE: Marian
SITE NO: MCL S27
A.M.G. REFERENCE: 714 900 mE 7 660 900 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Dy3.32
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
APsb	0 to .26 m	Brownish black (7.5YR3/1) moist; brownish grey (7.5YR5/1) dry; few fine faint brown mottles; sandy clay loam; moderately moist very weak. Clear, to-
B1sb	.26 to .40 m	Brownish grey (7.5YR4/1) moist; few fine distinct yellow mottles; light clay; moderately moist very weak; many manganiferous nodules. Abrupt, to-
B21	.40 to .75 m	Greyish brown (7.5YR4/2) moist; many fine distinct yellow mottles; medium clay; strong; moderately moist moderately firm; few manganiferous nodules. Gradual, to-
B22	.75 to 1.20 m	Dull yellowish orange (10YR6/4) moist; yellowish grey (2.5Y6/1) moist; common fine distinct yellow mottles; light medium clay; strong; moderately moist moderately weak; few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM 1/3b	15b % @ 105C	Disp.Ratio R1	R2
						m.eq/100g				%						
Bulk .10	5.7	.02	.001							.039	1.69	.018				
.10	5.7	.02	.001	17 54 19 13		9	1.4	.94	.10	.042	1.67	.017	1.2	19 6	.66	
.20	5.9	.01	.001										1.3			
.40	6.1	.01	.001			9	2.9	1.2	.10	.023	1.70	.011				
.60	6.2	.02	.001	8 37 10 48		15	6.1	3.1	.20	.029	1.45	.018	3.6	31 18	.51	
.90	6.4	.02	.001	12 47 13 31		11	6.0	3.9	.20	.025	1.59	.009	2.7	25 13	.48	
1.20	6.7	.01	.001	4 51 17 30		12	6.8	5.0	.20	.029	1.57	.006	2.8			

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.3	.11	50	37	.33	220	40	1.0	2.2
.10	1.0	.10	70	46	.32				
.20	.76	.05	11	10	.12				

SOIL TYPE: Martin
SITE NO: MCL S28
A.M.G. REFERENCE: 688 900 mE 7 666 700 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Dy3.11
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Igneous rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .15 m	Brown (7.5YR4/3) moist; dull brown (7.5YR6/3) dry; clay loam; moderate; dry very firm. Clear, to-
B21	.15 to .45 m	Dull yellowish brown (10YR5/4) moist; few fine distinct yellow mottles, few fine distinct red mottles; medium clay; moderate; dry very firm; few manganiferous nodules. Diffuse, to-
B3	.45 to .75 m	Bright yellowish brown (10YR6/6) moist; many fine distinct grey mottles, few fine distinct red mottles; light clay; few rounded igneous rocks; weak; moderately moist very weak. Abrupt, to-
C	.75 to .80 m	Dry very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM 1/3b	15b % @ 105C	Disp.Ratio R1	R2
						m.eq/100g				%						
Bulk .10	5.7	.03	.001							.034	0.56	.016				
.10	6.1	.03	.002	14 47 19 24		10	3.2	1.7	.10	.033	0.60	.015	1.9	22 10	.68	
.15	6.2	.02	.001										1.9			
.30	6.0	.03	.001	7 34 12 50		15	5.0	3.7	.10	.022	1.01	.018	3.3	29 17	.66	
.60	5.6	.03	.002	5 53 10 34		10	2.2	2.9	.15	.015	2.14	.016	2.1	23 12	.64	
.80	5.9	.02	.002			8	2.1	3.0	.10	.011	2.35	.011				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.1	.08	22	19	.61	158	27	1.0	2.1
.10	.88	.07	14	12	.57				
.20	.72	.06	14	12	.55				

APPENDIX V (continued)

SOIL TYPE: Benholme
SITE NO: MCL S29
A.M.G. REFERENCE: 688 500 mE 7 662 100 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug3.2
SOIL TAXONOMY UNIT: Udorthentic Chromustert
FAO UNESCO UNIT:

TYPE OF MICRORELIEF: Normal gilgai
VERTICAL INTERVAL: 0.10 m
HORIZONTAL INTERVAL: 1 m
SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Tristania sauveolens; Eucalyptus alba; Eucalyptus tessellaris

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A11sb	0 to .10 m	Greyish yellow-brown (10YR4/2) moist; brownish grey (10YR6/1) dry; light medium clay; strong; dry moderately firm. Clear; to-
A12sb	.10 to .20 m	Greyish yellow-brown (10YR4/2) moist; few fine distinct brown mottles; medium clay; strong; moderately moist very firm; few manganiferous nodules. Clear; to-
B21	.20 to .50 m	Dull yellow (2.5Y6/3) moist; few fine faint yellow mottles; few fine faint grey mottles; heavy clay; strong; moist very firm; few manganiferous nodules. Gradual; to-
B22	.50 to .90 m	Yellowish grey (2.5Y5/1) moist; heavy clay; strong; moist very firm; few manganiferous nodules. Clear; to-
B23	.90 to 1.20 m	Greyish yellow (2.5Y6/2) moist; few fine faint yellow mottles; heavy clay; strong; moderately moist very firm; many carbonate nodules; many manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
						m.eq/100g												
Bulk .10	5.7	.03	.002								.027	0.56	.029					
.10	5.8	.03	.001	6	19 36 43	25	8.3	4.2	.15	.64	.019	0.53	.021	3.9	35	16	.62	
.20	6.0	.02	.001											5.0				
.30	6.2	.02	.002	2	10 18 75	34	18.	7.7	.95	.53	.013	0.45	.012	7.0	43	24	.69	
.60	6.4	.19	.031	2	9 22 72	39	25.	10.	2.1	.15	.012	0.48	.008	7.9	44	25	.72	
.90	7.9	.43	.061	2	12 26 64	37	25.	11.	3.1	.09	.015	0.65	.008	7.1	42	22	.82	
1.20	8.4	.48	.064	2	20 33 51	30	19.	8.7	3.0	.08	.023	0.92	.006	5.8				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.3	.19	4	17	.52	265	199	1.5	2.6
.10	1.6	.13	3	9	.62				
.20	1.1	.09	3	4	.60				

SOIL TYPE: Dunwold
SITE NO: MCL S30
A.M.G. REFERENCE: 684 400 mE 7 657 600 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy5.82
SOIL TAXONOMY UNIT: Ultic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Granite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Greyish yellow-brown (10YR4/2) moist; brownish grey (10YR6/1) dry; light sandy clay loam; dry loose. Clear; to-
A2cb	.10 to .40 m	Dull yellowish orange (10YR6/3) moist; dull yellowish orange (10YR7/2) dry; light sandy clay loam; dry loose. Abrupt; to-
A3	.40 to .50 m	Bright yellowish brown (10YR7/6) moist; sandy clay loam; dry very weak. Abrupt; to-
B21	.50 to .70 m	Bright yellowish brown (10YR7/6) moist; few fine distinct grey mottles; few fine distinct yellow mottles; medium clay; weak; moderately moist moderately weak. Clear; to-
B31	.70 to .95 m	Yellowish orange (10YR8/6) moist; sandy clay; dry very weak. Abrupt; to-
B32	.95 to 1.05 m	Light grey (5Y7/2) moist; common medium distinct yellow mottles; medium clay; weak; moderately moist moderately weak. Abrupt; to-
C	1.05 to 1.20 m	Yellowish orange (10YR8/6) moist; sandy clay; dry loose.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
						m.eq/100g												
Bulk .10	6.0	.05	.002								.027	1.25	.022					
.10	5.9	.03	.001	45	31 10 16	8	2.6	1.4	.10	.30	.024	1.26	.018	1.2	15	6	.54	
.20	6.2	.02	.001											0.9				
.30	6.2	.02	.001	45	32 13 16	6	1.8	1.1	.10	.29	.015	1.42	.010	1.0	12	5	.63	
.60	6.0	.03	.001	43	20 10 30	11	3.3	4.2	.15	.28	.011	2.05	.012	2.1	20	11	.72	
.90	6.8	.02	.001	60	19 5 19	9	2.6	6.5	.40	.04	.008	2.20	.004	1.8	13	6	.69	
1.20	7.4	.02	.002	47	25 13 16	9	2.9	6.3	.80	.03	.010	2.26	.003	1.8				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.4	.12	23	21	.49	156	42	0.5	1.5
.10	1.0	.11	26	24	.38				
.20	.58	.06	5	6	.33				

APPENDIX V (continued)

SOIL TYPE: Kuttabul, alluvial-colluvial variant
SITE NO: MCL S31
A.M.G. REFERENCE: 704 900 mE 7 663 200 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy2.41
SOIL TAXONOMY UNIT: Ultic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish grey (7.5YR4/1) moist, brownish grey (7.5YR6/1) dry; sandy clay loam; moderately moist very weak. Abrupt, to-
A2cb	.05 to .25 m	Brownish grey (7.5YR4/1) moist, light brownish grey (7.5YR7/1) dry; few fine distinct brown mottles; sandy clay loam; dry very weak. Clear, to-
B21	.25 to .55 m	Dull yellow (2.5Y6/4) moist; few fine faint grey mottles; medium clay; few subangular quartz; moderate; moderately moist moderately weak; few manganiferous nodules. Gradual, to-
B22	.55 to .80 m	Light grey (2.5Y7/1) moist; common fine distinct yellow mottles; few fine distinct red mottles; heavy clay; few subangular quartz; strong; moist moderately firm; very few manganiferous nodules. Clear, to-
B3	.80 to 1.20 m	Greyish white (N8/0) moist, bright yellowish brown (10YR6/8) moist; common fine prominent red mottles; medium heavy clay; few subangular quartz; strong; moist very firm.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
								m.eq/100g				%			% @ 105C				
Bulk .5	6.0	.02	.001									.018	0.22	.016					
.05	6.0	.02	.001	31	43	13	16	7	1.8	1.1	.10	.12	.015	0.23	.015	!0.9	19	4	.54
.20	6.2	.01	.001													!0.7			
.35	5.8	.01	.001	35	25	10	34	10	2.0	2.0	.10	.07	.013	0.26	.011	!2.3	19	10	.47
.70	6.0	.01	.001					14	2.3	2.7	.25	.09	.013	0.38	.010	!3.4			
.90	6.2	.01	.001	29	32	7	34	11	1.7	2.6	.25	.08	.011	0.29	.006	!2.3	21	11	.76
1.20	6.4	.01	.001	35	23	6	37	15	3.0	4.8	.45	.11	.011	0.46	.005	!2.9			

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K !m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.4	.10	11	13	.17	160	37	0.5	1.4
.10	1.3	.10	5	7	.11				
.20	.64	.04	3	4	.04				

SOIL TYPE: Kinchant, coarse sandy variant
SITE NO: MCL S32
A.M.G. REFERENCE: 689 900 mE 7 659 700 mN ZONE 55

GREAT SOIL GROUP: Gleyed podzolic soil
PRINCIPAL PROFILE FORM: Dy5.81
SOIL TAXONOMY UNIT: Haplustult
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus intermedia, Eucalyptus tessellaris, Melaleuca nervosa

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .03 m	Brownish black (10YR3/1) moist, brownish grey (7.5YR6/1) dry; light sandy clay loam; dry loose. Abrupt, to-
A21cb	.03 to .50 m	Brownish grey (10YR5/1) moist, light grey (10YR7/1) dry; loamy coarse sand; dry loose. Clear, to-
A22cb	.50 to .60 m	Greyish yellow-brown (10YR6/2) moist, light grey (10YR8/1) dry; sandy clay loam;fine sandy; moderately moist very weak. Clear, to-
B21	.60 to .70 m	Dull yellow (2.5Y6/3) moist; few medium distinct grey mottles, few fine distinct yellow mottles; sandy clay; weak; moderately moist moderately weak. Clear, to-
B22	.70 to .85 m	Greyish yellow (2.5Y6/2) moist; common fine distinct yellow mottles; light medium clay; weak; moderately moist moderately firm; few manganiferous nodules. Clear, to-
(D1)	.85 to 1.00 m	Light grey (10YR7/1) moist; many fine distinct yellow mottles; sandy clay; weak; moderately moist moderately firm; many manganiferous nodules. Clear, to-
(D2)	1.00 to 1.20 m	Light grey (2.5Y7/1) moist, bright yellowish brown (10YR6/6) moist; few fine prominent red mottles; light medium clay; weak; moderately moist moderately weak; very few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
								m.eq/100g				%			% @ 105C				
Bulk .3	6.1	.03	.001									.014	0.34	.015					
.03	6.1	.02	.001	70	21	4	6	4	1.2	.73	.45	.11	.014	0.35	.014	!0.6	9	3	.32
.20	6.3	.01	.001													!0.3			
.30	6.5	.01	.001	63	28	4	6	1	.29	.10	.10	.14	.006	0.39	.004	!0.2	5	1	.61
.60	6.2	.01	.001	60	26	4	12	4	.17	.19	.10	.25	.006	0.40	.004	!0.7	8	3	.60
.80	5.6	.01	.001										.007	0.33	.007				
.90	5.5	.01	.001	58	16	3	27	5	.32	.80	.10	.08	.010	0.32	.010	!1.5	13	8	.35
1.20	5.6	.01	.001	66	10	3	23	4	.19	.72	.10	.05	.007	0.33	.005	!1.2			

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K !m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.0	.08	3	5	.27	97	37	0.2	2.8
.10	.72	.07	4	5	.12				
.20	.44	.02	2	2	.10				

APPENDIX V (continued)

SOIL TYPE: Allandale, strongly sodic variant
SITE NO: MCL S33
A.M.G. REFERENCE: 699 800 mE 7 654 400 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz
PRINCIPAL PROFILE FORM: Dy2.43
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
	0 to .02 m	Loam; moderately moist very weak. Abrupt; to-
A1sb	.02 to .10 m	Greyish yellow-brown (10YR4/2) moist; few fine faint brown mottles; sandy loam; moderately moist very weak. Clear; to-
A21sb	.10 to .16 m	Brownish grey (10YR6/1) moist; few fine faint brown mottles; sandy loam; moderately moist very weak. Clear; to-
A22cb	.16 to .19 m	Light grey (10YR7/1) dry; sandy loam; moderately moist very weak. Abrupt; to-
B21	.19 to .50 m	Dull yellowish brown (10YR5/4) moist; sandy clay; strong 50-100mm columnar massive; dry moderately strong. Gradual; to-
B22	.50 to .85 m	Grey (5Y6/1) moist; common fine distinct yellow mottles; medium clay; few subangular unspecified coarse fragments; dry very firm. Abrupt; to-
D	.85 to 1.20 m	Light yellow (5Y7/4) moist; sandy clay loam;fine sandy; many subangular unspecified coarse fragments; dry; massive moderately cemented.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C			m.eq/100g						%		% @ 105C				
Bulk .10	5.7	.03	.002									.006	.07	.008					
.02	4.9	.18	.007	39 23	14	21	27	2.6	2.1	.65	.68	.055	.16	.086	3.6	46	24	.30	
.10	5.2	.03	.002	35 44	9	16	9	.85	.64	.23	.26	.010	.09	.010	1.0	13	5	.59	
.19	6.1	.02	.003												0.5				
.30	8.7	.11	.006	34 37	9	23	8	.35	.91	5.3	.10	.007	.07	.009	1.3	16	9	.86	
.50	9.8	.20	.009	29 35	6	31	10	.31	1.3	9.4	.12	.004	.12	.003	2.1	29	13	.96	
.85	9.8	.17	.008	27 32	6	38	16	.31	.98	11	.16	.002	.32	.001	2.9	45	19	.95	
1.20	9.7	.14	.009	31 25	12	33	23	.23	1.4	20	.20	.002	.72	.005	3.7				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	.76	.06	3	6	.26	214	6	0.1	0.2
. 2	6.6	.88	25	33	.64				
.10	1.3	.09	3	6	.18				
.20	.26	.02	2	3	.06				

SOIL TYPE: Kinchant
SITE NO: MCL S34
A.M.G. REFERENCE: 695 800 mE 7 657 200 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy5.41
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Melaleuca nervosa; Eucalyptus alba; Eucalyptus intermedia

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1	0 to .20 m	Yellowish grey (2.5Y4/1) moist; yellowish grey (2.5Y6/1) dry; loamy sand; dry loose. Gradual; to-
A21cb	.20 to .35 m	Light grey (2.5Y7/1) dry; loamy sand; dry loose. Gradual; to-
A22cb	.35 to .50 m	Light grey (2.5Y8/2) dry; loamy sand; dry loose. Abrupt; to-
B21	.50 to .80 m	Yellowish brown (10YR5/6) moist; grey (5Y6/1) moist; medium heavy clay; strong 10-20mm angular blocky; moderately moist very firm; very few manganiferous nodules. Gradual; to-
B22	.80 to 1.05 m	Light grey (2.5Y7/1) moist; many fine distinct yellow mottles; medium clay; moderately moist very firm; very few manganiferous nodules. Clear; to-
B23	1.05 to 1.20 m	Light grey (2.5Y7/1) moist; many fine distinct brown mottles; light medium clay; few rounded unspecified coarse fragments; moderately moist very firm.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS FS	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C			m.eq/100g						%		% @ 105C				
Bulk .10	5.4	.02	.001									.005	.08	.006					
.10	5.6	.01	.001	39 50	7	10	4	.57	.48	.20	.13	.005	.07	.005	0.5	7	2	.35	
.20	5.3	.01	.001												0.4				
.30	5.5	.01	.001	43 47	5	8	2	.19	.16	.10	.75	.002	.07	.001	0.3	5	1	.55	
.50	5.7	.01	.001																
.60				37 28	2	36	10	.08	2.0	1.2	.14	.004	.13	.004	2.0	21	13	.81	
.90	5.4	.07	.009	34 34	5	29	11	.26	3.8	2.1	.11	.002	.22	.002	2.3	23	11	.89	
1.20	5.2	.22	.035	15 40	18	31	26	.45	10	6.6	.18	.005	.72	.021	4.7				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	.84	.05	3	4	.10	132	9	0.1	1.1
.10	.66	.04	2	3	.10				
.20	.38	.03	2	3	.11				

APPENDIX V (continued)

SOIL TYPE: Allandale
SITE NO: MCL 535
A.M.G. REFERENCE: 697 400 mE 7 654 000 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.31
SOIL TAXONOMY UNIT: Aquic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Melaleuca nervosa, Eucalyptus alba

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .15 m	Greyish yellow-brown (10YR4/2) moist; light sandy clay loam; moderately moist very weak. Clear, to-
B21	.15 to .50 m	Dull yellowish brown (10YR5/3) moist; many fine distinct yellow mottles, few fine distinct grey mottles; medium heavy clay; moderately moist very firm; few manganiferous nodules. Gradual, to-
B22	.50 to .95 m	Dull yellow (2.5Y6/3) moist; common fine distinct yellow mottles, few fine distinct grey mottles; medium heavy clay; moderately moist very firm; few manganiferous nodules. Clear, to-
D1	.95 to 1.05 m	Dull yellow (2.5Y6/3) moist; few fine distinct yellow mottles; medium clay; moderately moist very firm; few manganiferous nodules. Gradual, to-
D2	1.05 to 1.20 m	Dull yellowish orange (10YR7/4) moist; sandy clay loam; moderately moist moderately weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
								m.eq/100g							% @ 105C				
Bulk .10	5.5	.05	.004									.007	.05	.008					
.10	5.5	.02	.002	62	21	10 13	5	1.2	1.1	.12	.11	.006	.07	.007	0.9	11	3	.61	
.20	5.2	.02	.002												3.5				
.30	5.3	.02	.001	41	13	3 45	19	3	5.6	.80	.08	.005	.02	.005	4.5	24	14	.86	
.60	5.2	.13	.016	39	15	6 42	23	5.3	9.7	1.5	.07	.003	.03	.003	4.7	26	15	.93	
.90	5.7	.44	.069	33	15	10 46	27	7.1	15	3.1	.07	.001	.09	.002	5.2	32	17	.90	
1.20	7.0	.31	.048	35	48	10 11	33	13	20	8.0	.07	.034	.52	.002	5.7				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.0	.07	6	6	.25	171	29	0.3	0.8
.10	.82	.06	4	6	.09				
.20	.56	.04	2	3	.06				

SOIL TYPE: Tannalo
SITE NO: MCL 536
A.M.G. REFERENCE: 682 100 mE 7 651 500 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Gn2.21
SOIL TAXONOMY UNIT: Typic Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .20 m	Brownish black (5YR3/1) moist, brownish grey (7.5YR5/1) dry; coarse sandy loam; moderately moist very weak. Diffuse, to-
A2	.20 to .60 m	Dull reddish brown (5YR4/4) moist, greyish brown (7.5YR6/2) dry; coarse sandy loam; earthy; moderately moist very weak. Gradual, to-
B21	.60 to .85 m	Dull reddish brown (5YR5/4) moist; sandy clay loam,fine sandy; earthy; moderately moist very weak. Gradual, to-
D	.85 to 1.20 m	Dull reddish brown (5YR5/4) moist; coarse sandy loam; few subangular unspecified coarse fragments; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS % @ 105C	S	C	Exch. Cations CEC	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
								m.eq/100g							% @ 105C				
Bulk .10	5.6	.02	.002									.030	1.86	.009					
.10	5.7	.02	.001	54	28	10 13	7	2.3	.83	.10	.23	.032	1.88	.007	1.1	14	4	.77	
.20	5.6	.01	.007												1.0				
.30	5.5	.01	.001	46	32	10 13	4	1.9	.62	.10	.12	.030	1.85	.005	0.8	13	4	.85	
.60	5.8	.01	.001	43	35	10 17	4	2.0	.60	.10	.28	.031	1.89	.005	0.9	12	4	.68	
.85	5.8	.01	.001	46	32	9 18	5	2.9	.89	.10	.18	.032	1.91	.003	1.3	14	6	.69	
1.20	6.0	.01	.001	64	21	3 31	4	2.6	.97	.10	.13	.023	1.87	.003	1.0				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.86	.06	46	22	.27	60	36	0.3	1.5
.10	.80	.05	44	20	.25				
.20	.72	.06	38	17	.16				

APPENDIX V (continued)

SOIL TYPE: Gargett
SITE NO: MCL S37
A.M.G. REFERENCE: 684 200 mE 7 650 300 mN ZONE 55

GREAT SOIL GROUP: Gleyed podzolic soil
PRINCIPAL PROFILE FORM: Dy5.82
SOIL TAXONOMY UNIT: Arenic haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 02 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .15 m	Brownish grey (10YR5/1) moist; brownish grey (10YR6/1) moist; sandy loam; moderately moist loose. Gradual; to-
A21cb	.15 to .45 m	Greyish yellow-brown (10YR6/2) moist; light grey (10YR8/1) moist; sandy loam; moderately moist loose. Clear; to-
A22cb	.45 to .55 m	Dull yellowish orange (10YR6/4) moist; light grey (10YR8/1) dry; sandy loam; few angular unspecified coarse fragments; moderately moist loose. Abrupt; to-
B21	.55 to .85 m	Yellowish grey (2.5Y6/1) moist; many fine distinct yellow mottles; medium clay; moderately moist moderately firm; few manganiferous nodules. Clear; to-
D1	.85 to 1.10 m	Light grey (2.5Y7/1) moist; light yellow (2.5Y7/4) moist; few medium distinct grey mottles; few medium distinct yellow mottles; sandy clay; few subangular unspecified coarse fragments; moderately moist moderately weak; few manganiferous nodules. Clear; to-
D2	1.10 to 1.20 m	Light grey (2.5Y7/1) moist; few fine distinct gley mottles; few fine distinct yellow mottles; sandy clay; few subangular unspecified coarse fragments; wet moderately weak; few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
							m.eq/100g											
Bulk .10	5.6	.01	.001								.011	1.70	.006					
.10	5.5	.01	.001	37	46	8 10	4	1.4	.68	.10 .15	.008	1.64	.005	0.7	10	3	.68	
.20	5.4	.01	.001											0.6				
.30	5.5	.01	.001	39	45	10 10	2	.98	.23	.10 .08	.006	1.74	.008	0.5	10	2	.63	
.55	6.1	.01	.001	36	45	8 12	2	1.2	.50	.10 .07	.006	1.75	.006	0.7	9	3	.60	
.85	6.4	.02	.001	33	39	8 23	9	4.6	2.5	.65 .10	.006	1.65	.006	2.1	19	8	.81	
1.10	6.1	.02	.001	46	29	7 20	8	4.1	2.2	.63 .12	.016	1.89	.006	2.1				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.76	.05	3	3	.17	35	17	0.1	0.5
.10	.58	.05	3	2	.13				
.20	.46	.03	2	2	.08				

SOIL TYPE: Pinnacle
SITE NO: MCL S38
A.M.G. REFERENCE: 676 300 mE 7 660 700 mN ZONE 55

GREAT SOIL GROUP: Krasnozem
PRINCIPAL PROFILE FORM: Uf6.31
SOIL TAXONOMY UNIT: Tropeptic Haplustox
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Igneous rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .10 m	Dark reddish grey (2.5YR3/1) moist; dull reddish brown (2.5YR4/3) dry; light clay; moderate (2mm granular; moderately moist moderately firm. Gradual; to-
A12	.10 to .40 m	Dark reddish grey (2.5YR3/1) moist; light clay; moderate (2mm granular; moderately moist moderately firm. Diffuse; to-
B21	.40 to 1.00 m	Dark reddish brown (2.5YR3/6) moist; light clay; moderate 10-20mm angular blocky strong 2-5mm subangular blocky; moderately moist moderately firm; very few manganiferous nodules. Diffuse; to-
B3	1.00 to 1.20 m	Red (10R4/8) moist; clay loam; moderate 10-20mm angular blocky strong 2-5mm subangular blocky; moderately moist moderately firm; very few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S % @ 105C	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
							m.eq/100g											
Bulk .10	4.8	.06	.002								.046	.15	.030					
.10	5.1	.04	.004	20	21	10 51	23	1.1	.91	.10 .73	.052	.22	.030	3.3	30	19	.50	
.20	5.2	.02	.002											3.3				
.30	5.3	.02	.001	16	27	10 48	19	1.9	.89	.10 .25	.038	.09	.030	3.4	28	18	.36	
.60	5.4	.01	.001	8	13	8 72	8	2.0	.82	.10 .16	.026	.07	.030	3.2	33	25	.18	
.90	4.9	.01	.002	6	10	11 76	10	1.8	1.0	.10 .13	.025	.04	.029	3.7	38	28	.15	
1.20	5.3	.01	.003	3	9	17 75	8	1.0	.68	.10 .10	.021	.05	.028	3.3				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.1	.12	16	23	.26	33	121	1.1	0.5
.10	2.6	.15	14	18	.63				
.20	2.0	.11	7	5	.38				

APPENDIX V (continued)

SOIL TYPE: Netherdale
SITE NO: MCL S39
A.M.G. REFERENCE: 673 100 mE 7 660 800 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Uf6.4
SOIL TAXONOMY UNIT: Typic Ustorthent
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few gravel

SUBSTRATE MATERIAL: Syenite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 18 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Rolling rises

VEGETATION
STRUCTURAL FORM: Open woodland
DOMINANT SPECIES: Eucalyptus intermedia, Eucalyptus tessellaris, Eucalyptus crebra

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Brown (7.5YR4/3) moist; light clay; strong 2-5mm granular; moderately moist moderately weak. Clear, to-
B3	.10 to .25 m	Dull yellowish brown (10YR5/4) moist; common fine distinct pale mottles; light clay; moderate 20-50mm prismatic weak 10-20mm angular blocky; moderately moist moderately weak. Gradual, to-
C1	.25 to .50 m	Sandy clay loam; moderately moist very weak. Diffuse, to-
C2	.50 to 1.05 m	Sandy loam; moderately moist loose. Diffuse, to-
C3	1.05 to 1.20 m	Sandy loam; few angular quartz; moderately moist loose.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS	S	C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.6	.02	.002									.043	1.04	.020					
.10	5.4	.02	.002	20	21	20 42	21	8.1	6.2	.15	.29	.043	1.02	.020	4.5	29	19	.58	
.20	5.5	.01	.001												4.5				
.35	5.8	.01	.001	31	26	14 31	16	9.8	6.0	.25	.13	.076	1.02	.013	4.1	28	15	.49	
.60	6.3	.01	.001	44	30	10 17	11	11	5.9	.26	.10	.105	1.02	.010	3.7	22	11	.49	
.90	6.4	.01	.001	56	27	7 13	9	11	5.4	.29	.09	.118	.96	.007	3.2	15	8	.52	
1.20	6.7	.01	.001	65	22	4 10	10	11	5.2	.25	.10	.155	1.29	.007	3.1				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.6	.11	8	10	.32	65	13	0.9	0.7
.10	1.3	.10	5	7	.26				
.20	.68	.08	6	7	.18				

SOIL TYPE: Uruba
SITE NO: MCL S40
A.M.G. REFERENCE: 669 000 mE 7 662 300 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy2.72
SOIL TAXONOMY UNIT: Paleustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Granodiorite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 16 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Rolling rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish yellow-brown (10YR4/2) moist, brownish grey (10YR6/1) dry; sandy clay loam; dry moderately weak. Clear, to-
A2sb	.15 to .25 m	Dull yellowish brown (10YR5/3) moist; sandy clay loam; dry moderately weak. Clear, to-
B21	.25 to .55 m	Bright brown (7.5YR5/6) moist; few fine distinct pale mottles; light medium clay; weak 20-50mm angular blocky; moderately moist moderately weak. Gradual, to-
C	.55 to 1.20 m	Loamy sand; moderately moist loose.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS	S	C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	6.1	.02	.002									.025	3.15	.021					
.10	5.9	.02	.001	36	34	13 20	9	4.5	1.4	.10	.20	.017	3.40	.016	1.7	18	7	.56	
.25	5.8	.01	.001												1.5				
.35	5.8	.01	.001	33	28	11 31	8	3.7	1.7	.10	.10	.009	3.18	.010	2.2	20	11	.63	
.55	5.9	.01	.001	31	26	14 34	9	3.8	2.1	.10	.10	.010	2.86	.011	2.6	24	13	.36	
.90	6.4	.01	.001	52	32	6 11	6	3.3	1.9	.10	.08	.033	2.95	.006	1.6	13	5	.53	
1.20	6.3	.01	.001	55	30	7 10	6	3.9	2	.22	.05	.034	2.96	.006	1.5				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.3	.11	14	12	.41	63	26	0.5	2.0
.10	1.4	.09	5	4	.24				
.20	.64	.06	2	2	.10				

APPENDIX V (continued)

SOIL TYPE: Kowari
SITE NO: MCL S41
A.M.G. REFERENCE: 661 500 mE 7 661 600 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Um5.52
SOIL TAXONOMY UNIT: Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Abundant cobbles

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Firm

HORIZON	DEPTH	DESCRIPTION
A1	0 to .40 m	Black (10YR2/1) moist; brownish grey (7.5YR4/1) dry; loam; many subangular unspecified coarse fragments; moderate (2mm granular; moderately moist very weak. Diffuse, to-
B21	.40 to .75 m	Brownish black (7.5YR3/2) moist; loam; abundant subangular unspecified coarse fragments; weak 2-5mm granular; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca Mg Na K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM %	1/3b % @ 105C	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.9	.04	.002				.172	1.38	.046					
.10	5.7	.04	.003	29 25 18 31	42	8.1 2.9 .10 .71	.224	1.30	.056	5.0	41	20	.24	
.20	5.5	.02	.002							4.9				
.30	5.5	.02	.002	33 26 16 29	40	6.8 1.7 .10 .71	.224	1.25	.051	4.8	34	18	.15	
.60	5.5	.01	.001	35 29 15 25	29	2.8 .69 .10 .49	.152	1.29	.044	4.8	35	16	.22	
.75	5.6	.01	.001											

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	4.9	.25	342	144	1.0	134	17	1.5	1.8
.10	6.4	.27	318	198	.64				
.20	4.8	.28	222	204	.68				

SOIL TYPE: Finch Hatton
SITE NO: MCL S42
A.M.G. REFERENCE: 677 400 mE 7 663 400 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Uf6.31
SOIL TAXONOMY UNIT: Typic Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Granodiorite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .20 m	Black (10YR2/1) moist; light clay; dry very firm. Gradual, to-
B21	.20 to .30 m	Dark reddish brown (5YR3/3) moist; dull reddish brown (5YR4/4) moist; medium clay; dry very firm; very few manganiferous nodules. Clear, to-
B22	.30 to .50 m	Brown (7.5YR4/6) moist; few fine distinct red mottles; medium clay; moderately moist moderately firm; few manganiferous nodules. Gradual, to-
B23	.50 to .80 m	Bright brown (7.5YR5/6) moist; light medium clay; moderately moist moderately firm; few manganiferous nodules. Gradual, to-
BC	.80 to 1.05 m	Orange (7.5YR6/6) moist; medium clay; moderately moist moderately firm. Gradual, to-
C	1.05 to 1.20 m	Sandy clay loam; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca Mg Na K m.eq/100g	Total Elements P %	K %	S %	Moistures ADM %	1/3b % @ 105C	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.2	.03	.002				.061	.80	.025					
.10	5.3	.02	.002	23 27 9 41	23	4.1 2.0 .10 .30	.061	.82	.022	3.9	25	15	.51	
.20	5.3	.02	.002							3.5				
.30	5.5	.02	.001	14 18 10 59	19	5.9 1.9 .12 .10	.030	.41	.022	4.4	35	24	.32	
.50	5.8	.02	.001	15 18 17 53	18	5.5 1.9 .15 .08	.022	.27	.015	5.0	40	25	.38	
.90	6.2	.01	.001	23 27 17 34	16	8.9 3.9 .21 .06	.015	.42	.007	4.4	29	20	.23	
1.20	6.3	.01	.001	36 35 7 24	17	12. 5.3 .20 .05	.048	.46	.006	4.3				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.8	.12	17	20	.41	92	60	1.5	1.0
.10	2.0	.11	14	15	.27				
.20	2.0	.11	11	12	.13				

APPENDIX V (continued)

SOIL TYPE: Pioneer
SITE NO: MCL S43
A.M.G. REFERENCE: 715 600 mE 7 658 300 mN ZONE 55

GREAT SOIL GROUP: Non-calcic brown soil
PRINCIPAL PROFILE FORM: Db2.51
SOIL TAXONOMY UNIT: Pachic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 01 %
LANDFORM ELEMENT TYPE: Levee
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .50 m	Brownish black (7.5YR3/1) moist; brownish grey (7.5YR5/1) dry; sandy clay loam; moderately moist moderately weak. Gradual; to-
A3	.50 to .65 m	Greyish brown (7.5YR4/2) moist; sandy clay loam; moderately moist moderately weak. Gradual; to-
B21	.65 to 1.00 m	Brown (7.5YR4/4) moist; many medium distinct dark mottles; few fine distinct yellow mottles; light medium clay; moderately moist moderately weak; few manganiferous soft segregations. Diffuse; to-
D	1.00 to 1.20 m	Dull yellowish brown (10YR5/4) moist; sandy clay; moderately moist moderately weak; few manganiferous soft segregations.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	4.8	.04	.002										1.8				
.10	4.8	.06	.003	10 55 16 17	14	2.2	1	.10	.32	.042	1.42	.009	1.8	22	8	.82	
.20	4.9	.06	.003														
.30	4.9	.03	.002	10 55 15 18	14	1.8	.78	.10	.16	.040	1.37	.010	1.9	22	9	.75	
.60	5.0	.05	.002	10 58 13 20	12	3.2	1	.10	.18	.036	1.55	.011	2.0	21	10	.64	
.90	5.7	.03	.001	8 49 13 31	14	6.2	3.2	.15	.11	.032	1.44	.013	3.1	28	14	.34	
1.20	6.1	.03	.002	13 57 10 20	9	5.4	3.5	.15	.08	.027	1.55	.006	2.1				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.0	.08	74	65	.36	130	75	1.1	1.6
.10	1.1	.08	65	64	.38	120	81	1.0	1.3
.20	1.0	.07	58	16	.28				

SOIL TYPE: Marwood
SITE NO: MCL S44
A.M.G. REFERENCE: 721 200 mE 7 644 700 mN ZONE 55

GREAT SOIL GROUP: Podzol
PRINCIPAL PROFILE FORM: Uc3.21
SOIL TAXONOMY UNIT: Spodosol
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Tuff
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus intermedia; Melaleuca viridiflora

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish black (7.5YR3/1) moist; brownish grey (10YR5/1) dry; loamy coarse sand; moderately moist loose. Clear; to-
A12sb	.05 to .45 m	Brownish grey (10YR4/1) moist; loamy coarse sand; moderately moist loose. Clear; to-
B21hir	.45 to .55 m	Brown (7.5YR4/3) moist; loamy coarse sand; few subangular quartz; moderately moist loose. Clear; to-
2A21b	.55 to .95 m	Dull yellowish orange (10YR7/2) moist; few medium prominent dark mottles; coarse sand; few subangular quartz; moderately moist loose. Clear; to-
2A22b	.95 to 1.10 m	Light grey (10YR7/1) moist; few fine prominent yellow mottles; coarse sand; few subangular quartz; moist loose. Abrupt; to-
2B21	1.10 to 1.20 m	Light grey (10YR7/1) moist; brownish grey (7.5YR6/1) dry; few fine distinct yellow mottles; medium clay; few subangular quartz; moist moderately weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.8	.01	.001										0.3				
.05	5.8	.02	.001	55 39 1 5	2	.67	.52	.10	.06	.007	0.47	.005	0.3	6	1	.46	
.20	5.8	.01	.001														
.30	5.6	.01	.001	64 30 2 1	2	.06	.05	.10	.03	.010	0.45	.004	0.2	4	1	.22	
.55	5.5	.01	.001	68 25 2 2	2	.05	.06	.10	.03	.013	0.56	.006	0.5	6	2	.15	
.90	5.4	.01	.001	67 25 1 4	1	.21	.40	.10	.03	.005	0.40	.002	0.2	4	1	.99	
1.10	5.4	.01	.001														
1.20	5.2	.01	.001	66 11 3 17	3	.07	.67	.10	.03	.007	0.52	.004	0.8				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.46	.04	5	5	.09	19	7	0.1	0.4
.10	.56	.03	3	4	.10	15	8	0.2	0.5
.20	.36	.03	2	3	.07				

APPENDIX V (continued)

SOIL TYPE: Munbura
SITE NO: MCL S45
A.M.G. REFERENCE: 723 000 mE 7 640 800 mN ZONE 55

GREAT SOIL GROUP: Red podzolic soil
PRINCIPAL PROFILE FORM: Dr4.81
SOIL TAXONOMY UNIT: Paleustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few gravel

SUBSTRATE MATERIAL: Tuff
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish black (7.5YR3/1) moist; brownish grey (10YR5/1) dry; sandy loam; few subangular quartz; moderately moist loose. Clear; to-
A2cb	.15 to .35 m	Dull yellowish brown (10YR5/3) moist; light grey (10YR7/1) dry; loamy sand; many subangular quartz; moderately moist loose. Abrupt; to-
B21	.35 to .70 m	Red (10R4/8) moist; few fine distinct yellow mottles; light clay; few subangular quartz; moderately moist moderately weak. Gradual; to-
B22	.70 to 1.10 m	Red (10R4/8) moist; few fine distinct yellow mottles; light clay; few subangular quartz; moderately moist moderately weak. Clear; to-
BC	1.10 to 1.20 m	Red (10R4/8) moist; common fine distinct yellow mottles; light clay; few subangular quartz; moderately moist moderately weak.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS	FS	S	C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.4	.02	.001													0.6				
.10	5.6	.03	.001	59	29	4	7	6	.61	.44	.10	.19	.014	1.14	.011	0.6	9	3	.71	
.20	5.4	.02	.001																	
.30	5.3	.01	.001	56	30	6	6	3	.21	.04	.10	.08	.009	1.46	.006	0.4	7	2	.69	
.60	5.1	.02	.002	35	16	10	38	6	1.2	1.8	.10	.06	.007	1.09	.009	1.7	24	15	.01	
.90	5.1	.02	.002	29	21	14	38	6	.90	2.0	.10	.08	.007	1.33	.012	1.9	24	14	.04	
1.20	5.1	.02	.002	24	22	14	39	7	.67	2.2	.10	.10	.006	1.70	.011	2.1				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.70	.08	3	6	.24	47	35	0.1	0.5
.10	1.0	.09	5	9	.32	44	38	0.1	0.6
.20	.74	.03	3	6	.17				

SOIL TYPE: Dundula
SITE NO: MCL S46
A.M.G. REFERENCE: 723 800 mE 7 653 000 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug3.2
SOIL TAXONOMY UNIT: Udorthentic Pellustert
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus tereticornis

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking; poached

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish grey (10YR4/1) moist; greyish yellow-brown (10YR5/2) dry; common fine distinct brown mottles; light medium clay; moderately moist moderately firm. Clear; to-
A2sb	.05 to .20 m	Brownish grey (10YR4/1) moist; common fine distinct brown mottles; light medium clay; moderately moist moderately firm; few manganiferous nodules. Clear; to-
B21	.20 to .40 m	Brownish grey (10YR5/1) moist; many fine distinct brown mottles; medium clay; moderately moist moderately firm; few manganiferous nodules. Gradual; to-
B22	.40 to .65 m	Yellowish grey (2.5Y6/1) moist; common fine distinct brown mottles; heavy clay; moderately moist very firm. Clear; to-
D1	.65 to .90 m	Grey (N6/0) moist; few fine distinct yellow mottles; heavy clay; moderately moist very firm; few manganiferous nodules. Gradual; to-
D2	.90 to 1.20 m	Grey (10Y6/1) moist; common fine distinct yellow mottles; few fine distinct grey mottles; medium heavy clay; moist; very few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS	FS	S	C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S %	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.4	.07	.007													4.2				
.05	5.5	.05	.003	22	34	18	31	21	4.3	5.5	.30	.48	.024	0.92	.028	3.1	28	13	.57	
.20	6.0	.02	.001																	
.30	5.8	.04	.003	11	33	17	43	23	4.8	8.0	.99	.23	.011	0.89	.010	4.5	30	16	.64	
.60	5.6	.31	.053	7	30	17	50	23	4.8	11.	2.5	.23	.010	0.90	.014	4.6	35	19	.92	
.90	6.9	.73	.122	8	23	18	53	33	7.0	30.	5.6	.30	.009	0.89	.016	6.2	41	21	.99	
1.20	7.5	1.2	.181	6	20	18	61	33	7.4	32.	7.1	.37	.009	0.98	.022	6.6				

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.2	.10	5	7	.38	66	122	1.9	1.2
.10	2.0	.17	5	13	.47	110	206	2.6	1.8
.20	.82	.07	2	4	.20				

APPENDIX V (continued)

SOIL TYPE: Balberra
SITE NO: MCL S47
A.M.G. REFERENCE: 721 000 mE 7 638 800 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.42
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Tristania sauveolens, Eucalyptus alba, Melaleuca viridiflora

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .10 m	Dark greyish yellow (2.5Y5/2) moist; clay loam,fine sandy; moderately moist moderately weak. Gradual, to-
A2cb	.10 to .35 m	Greyish yellow (2.5Y7/2) moist; few medium faint yellow mottles; clay loam,fine sandy; moderately moist moderately weak. Clear, to-
B21	.35 to .65 m	Greyish yellow (2.5Y6/2) moist, dull yellow (2.5Y6/4) moist; medium clay; few subangular unspecified coarse fragments; moderately moist moderately firm. Diffuse, to-
B22	.65 to 1.00 m	Dull yellow (2.5Y6/4) moist; greyish yellow (2.5Y6/2) moist; medium clay; moderately moist moderately firm. Diffuse, to-
B23	1.00 to 1.20 m	Yellowish grey (2.5Y6/1) moist; common fine distinct yellow mottles; medium clay; moderately moist moderately firm; very few manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.7	.02	.003													1.1				
.10	6.0	.02	.002	13	54	28	14	7	1.9	1.4	.12	.13	.011	0.43	.011	1.2	23	5	.82	
.20	5.8	.01	.001																	
.30	5.8	.01	.001	10	51	27	20	6	.85	1.2	.30	.65	.070	0.44	.006	1.3	19	7	.87	
.60	5.7	.03	.004	9	35	14	45	18	4.5	4.9	1.3	.15	.008	0.55	.004	3.8	28	15	.85	
.90	5.8	.09	.013	6	41	23	35	18	7.1	7.0	2.1	.10	.006	0.69	.003	3.9	29	15	.99	
1.20	6.7	.20	.029	9	30	24	42	18	7.5	7.3	2.8	.08	.007	0.55	.002	3.8				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.3	.09	4	6	.16	82	48	0.6	0.8
.10	1.1	.09	3	8	.13	79	52	0.6	1.5
.20	.50	.05	2	5	.07				

SOIL TYPE: Sunnyside
SITE NO: MCL S48
A.M.G. REFERENCE: 721 400 mE 7 638 400 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1cb	0 to .22 m	Brownish grey (10YR5/1) moist; light grey (10YR7/1) dry; silty clay loam; moderately moist moderately weak. Abrupt, to-
B21	.22 to .80 m	Light grey (2.5Y7/1) moist; yellowish brown (10YR5/6) moist; medium heavy clay; moderately moist very firm; very few manganiferous nodules. Gradual, to-
B22	.80 to 1.20 m	Yellowish grey (2.5Y4/1) moist; common fine distinct yellow mottles; heavy clay; moderately moist very firm; few manganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.0	.03	.002													2.6				
.10	5.0	.03	.002	12	41	30	24	13	3.1	1.8	.15	.17	.018	0.41	.014	2.4	29	10	.77	
.20	5.5	.02	.001																	
.30	5.6	.02	.001	9	36	26	34	14	4.9	2.9	.25	.15	.010	0.45	.005	2.8	25	12	.79	
.60	6.2	.02	.001	9	25	21	49	22	9.1	6.1	.10	.24	.010	0.53	.005	4.6	31	17	.90	
.90	6.4	.05	.006	10	23	21	49	25	12.	7.9	.10	.17	.008	0.54	.004	4.9	34	18	.98	
1.20	7.1	.11	.013	9	31	24	42	23	12.	7.9	.10	.88	.008	0.53	.004	4.4				

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.7	.14	5	18	.19	280	204	2.6	1.3
.10	1.3	.10	3	13	.21	216	186	2.5	1.1
.20	.74	.06	2	6	.12				

APPENDIX V (continued)

SOIL TYPE: Septimus
SITE NO: MCL 849
A.M.G. REFERENCE: 776 200 mE 7 657 100 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Uc2.21
SOIL TAXONOMY UNIT: Typic Ustipsamment
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few gravel

SUBSTRATE MATERIAL: Granite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
APcb	0 to .50 m	Greyish yellow-brown (10YR4/2) moist; dull yellowish orange (10YR7/2) dry; coarse sandy loam; few subangular quartz; dry loose. Clear; to-
B21	.50 to .60 m	Bright yellowish brown (10YR6/6) moist; sandy loam; few subangular quartz; dry very weak. Clear; to-
B3	.60 to .85 m	Bright yellowish brown (10YR6/6) moist; sandy loam; few subangular quartz; dry very weak. Clear; to-
C	.85 to 1.15 m	Bright yellowish brown (10YR7/6) moist; sandy loam; few subangular quartz; dry very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.2	.01	.001										0.7				
.10	5.2	.01	.001	62 25 7 5	4	.42	.23	.20	.35	.011	2.41	.003	0.7	10	3	.88	
.20	5.1	.01	.001														
.30	5.2	.01	.001	61 25 7 6	4	.39	.23	.31	.18	.010	2.36	.003	0.7	9	3	.81	
.60	5.6	.01	.001	58 24 7 10	6	3.6	1.3	.18	1.0	.009	2.46	.002	1.3	11	5	.76	
.85	5.8	.01	.001		8	4.7	2.9	.30	.20								
1.15	6.2	.01	.001	59 26 7 6	6	3.2	2.1	.42	.11				1.3	9	4	.67	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid ppm	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.38	.02	11	14	.25	30	34	0.1	0.2
.10	.32	.02	8	9	.22	24	32	0.1	0.4
.20	.22	.02	9	10	.19				

SOIL TYPE: Nabilla
SITE NO: MCL 850
A.M.G. REFERENCE: 704 000 mE 7 658 100 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Gn3.72
SOIL TAXONOMY UNIT: Typic Haplumbrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Brownish black (7.5YR2/2) moist; greyish brown (7.5YR4/2) dry; clay loam; moderately moist moderately weak; many manganiferous nodules. Clear; to-
A12	.25 to .35 m	Brownish black (7.5YR3/2) moist; light clay; moderately moist moderately weak; many manganiferous nodules. Gradual; to-
B21	.35 to .70 m	Yellowish brown (10YR5/6) moist; few fine prominent red mottles; few fine distinct grey mottles; medium heavy clay; moderately moist moderately firm; few manganiferous nodules. Clear; to-
BC	.70 to .80 m	Yellowish orange (10YR7/8) moist; brownish grey (10YR6/1) moist; medium clay; moderately moist moderately firm; very few manganiferous nodules. Abrupt; to-
C	.80 to .85 m	Light clay; few angular andesite; moderately moist very weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.2	.04	.001										2.9				
.10	5.1	.05	.001	37 35 16 14	17	2.2	1.3	.53	.08	.053	0.38	.013	3.1	19	11	.72	
.20	5.0	.04	.001														
.35	5.4	.02	.001	48 26 13 17	17	2.8	1.7	.55	.07	.027	0.43	.011	3.5	18	12	.65	
.60	6.1	.02	.001	8 13 17 64	28	8.3	9.3	.16	.12	.013	0.11	.011	6.5	47	28	.36	
.80	6.4	.02	.001														
.85	6.7	.02	.001	35 29 24 17	24	12.	12.	.38	.05	.016	0.37	.006	4.7	29	14	.59	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid ppm	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	.88	.06	13	32	.30	92	182	2.9	1.3
.10	1.0	.07	15	44	.33	97	172	2.8	1.4
.20	.64	.07	10	31	.25				

APPENDIX V (continued)

SOIL TYPE: Eton
SITE NO: MCL S51
A.M.G. REFERENCE: 703 300 mE 7 647 600 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Gn3.03
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
APsb	0 to .20 m	Yellowish grey (2.5Y4/1) moist; yellowish grey (2.5Y6/1) dry; clay loam;fine sandy; moderately moist moderately weak. Clear; to-
B1sb	.20 to .35 m	Yellowish grey (2.5Y4/1) moist; light clay; moderately moist moderately weak. Clear; to-
B21	.35 to .80 m	Yellowish grey (2.5Y4/1) moist; few fine faint brown mottles; medium heavy clay; moderately moist moderately firm; few manganiferous nodules. Clear; to-
B22	.80 to 1.20 m	Yellowish grey (2.5Y5/1) moist; common medium faint yellow mottles; medium heavy clay; moderately moist moderately firm; many carbonate nodules; few manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .10	5.4	.02	.001										2.2				
.10	5.6	.08	.001	14 36 28 23	15	5.1	3.3	.10	.56	.026	1.32	.012	2.2	27	8	.77	
.20	5.5	.02	.001														
.30	5.5	.04	.004	12 33 29 27	16	6.3	3.7	.16	.22	.015	1.36	.011	2.5	27	10	.72	
.60	7.2	.13	.019	11 27 24 38	22	9.7	8.9	1.2	.18	.012	1.38	.008	3.8	29	14	.85	
.90	8.7	.33	.042	15 27 19 36	21	8.2	11.	2.1	.16	.011	1.47	.008	3.8	29	13	.85	
1.20	8.9	.44	.055	17 26 20 38	24	7.6	13.	3.3	.15	.013	1.45	.008	4.1				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.1	.10	27	30	.31	121	70	1.9	0.7
.10	.86	.09	47	44	.54	100	66	1.7	0.8
.20	.84	.08	25	23	.50				

SOIL TYPE: Palmyra
SITE NO: MCL S52
A.M.G. REFERENCE: 713 600 mE 7 648 600 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT: Ultic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Sedimentary rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .10 m	Dark greyish yellow (2.5Y4/2) moist; light grey (2.5Y7/1) dry; few fine faint brown mottles; sandy clay loam; dry moderately weak. Clear; to-
A2cb	.10 to .45 m	Light grey (10YR8/1) dry; sandy clay loam; abundant subangular unspecified coarse fragments; dry. Gradual; to-
A3cb	.45 to .50 m	Greyish yellow-brown (10YR5/2) moist; light grey (10YR8/1) dry; sandy clay loam; abundant subangular unspecified coarse fragments; unspecified coarse fragments; dry. Clear; to-
B21	.50 to .70 m	Greyish olive (5Y5/2) moist; common fine distinct grey mottles; common fine distinct yellow mottles; medium clay; many subangular unspecified coarse fragments; moderately moist moderately firm.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	Exch. Cations CEC	Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b % @ 105C	15b	Disp.Ratio R1	R2
Bulk .10	5.3	.09	.003														
.10	5.5	.04	.004	19 34 31 14	12	6.6	1.4	.19	.18	.025	0.57	.020	1.54	24	6	.83	
.20	5.4	.05	.006										1.36				
.30	5.7	.01	.002	32 28 28 12	1	NS	L			.028	0.87	.010	1.33	NS	6	.78	
.60	5.2	.02	.002	17 17 24 40	14	2.1	5.7	.78	.10	.010	0.75	.007	2.76	28	14	.81	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.1	.17	10	12	0.4	207	49	0.7	1.5
.10	2.0	.15	10	12	0.4	200	048	0.7	1.1
.20	1.2	.05	4	6	0.2				

APPENDIX V (continued)

SOIL TYPE: Brightley
SITE NO: MCL S53
A.M.G. REFERENCE: 703 200 mE 7 648 700 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Ug5.24
SOIL TAXONOMY UNIT: Udic Pellustert
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking, recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .20 m	Brownish black (10YR3/1) moist, brownish grey (10YR5/1) dry; light clay; moderately moist moderately firm. Gradual, to-
B21	.20 to .40 m	Brownish grey (10YR4/1) moist; medium clay; moderately moist very firm. Diffuse, to-
B22	.40 to 1.20 m	Brownish grey (10YR4/1) moist; few fine faint yellow mottles; medium heavy clay; few subangular unspecified coarse fragments; moderately moist very firm; very few manganiferous nodules.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM 1/3b 15b % @ 105C			Disp.Ratio R1	R2
Bulk .10	5.5	.09	.013														
.10	5.4	.08	.010	7 26 78 40	35	11	5.9	.25	.43	.043	1.01	.018	3.58	30	15	.61	
.20	5.1	.06	.007										2.99				
.30	5.9	.04	.003	5 21 28 46	30	11	6.7	.38	.29	.024	0.92	.015	4.2	33	17	.69	
.60	6.9	.05	.006	3 17 22 57	34	18	13	1.3	.15	.012	0.83	.009	5.35	39	21	.86	
.90	7.3	.21	.036	4 18 21 55	35	18	14	2.5	.13	.010	0.86	.008	5.53	39	21	.83	
1.20	7.5	.32	.057	5 20 20 54	37	20	16	3.1	.13	.011	0.98	.006	5.90	38	20	.83	

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.6	.12	140	111	0.1	162	39	4.0	1.7
.10	1.8	.12	86	98	0.1	186	51	4.4	1.9
.20	1.6	.11	40	34	0.5				

SOIL TYPE: Wollingford
SITE NO: MCL S54
A.M.G. REFERENCE: 690 900 mE 7 650 700 mN ZONE 55

GREAT SOIL GROUP: Solodic
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT: Aquic Paleustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few gravel

SUBSTRATE MATERIAL: Igneous rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 05 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .35 m	Greyish yellow-brown (10YR4/2) moist; brownish grey (10YR6/1) dry; sandy clay loam; weak 5-10mm subangular blocky; dry moderately weak. Clear, to-
B21	.35 to .50 m	Brownish grey (10YR5/1) moist; dull reddish brown (5YR5/4) moist; common fine distinct brown mottles; medium clay; moderate 50-100mm prismatic strong 20-50mm angular blocky; moderately moist very firm. Clear, to-
BC	.50 to .80 m	Dull yellow (2.5Y6/3) moist; grey (N6/0) moist; medium clay; few angular igneous rocks; dry very firm. Gradual, to-
C	.80 to 1.00 m	Grey (N6/0) moist, dull yellow (2.5Y6/3) moist; sandy clay; many angular igneous rocks; dry.

Depth (metres)	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM 1/3b 15b % @ 105C			Disp.Ratio R1	R2
Bulk .10	6.0	.16	.016														
.10	5.5	.10	.012	30 33 16 19	15	4.3	2.1	.49	.19	.033	0.67	.012	1.91	20	9	.90	
.20	5.5	.05	.005										1.77				
.30	5.5	.04	.004	30 32 16 20	15	3.6	1.7	.37	.21	.038	0.73	.011	2.07	21	10	.88	
.50	5.5	.08	.010	9 12 19 57	20	11	3.7	.85	.15	.061	6.47	.011	3.89	32	18	.84	
.90	8.6	.11	.007	42 13 20 23	18	18	4	1.3	.06	.030	2.29	.006	3.33	18	11	.73	

Depth (metres)	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.0	.08	130	101	0.4	137	88	0.6	0.9
.10	0.9	.07	113	83	0.2	150	53	0.5	1.1
.20	0.9	.07	140	105	0.3	150	53	0.5	1.1

APPENDIX V (continued)

SOIL TYPE: Mentmore
SITE NO: MCL S55
A.M.G. REFERENCE: 705 900 mE 7 678 700 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy2.41
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL: Tuff
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 04 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish yellow-brown (10YR4/2) moist; brownish grey (10YR6/1) dry; light sandy clay loam; dry moderately weak. Gradual, to-
A21cb	.15 to .30 m	Dull yellowish orange (10YR6/3) moist, light grey (10YR8/1) dry; sandy clay loam; dry moderately weak. Clear, to-
A22cb	.30 to .35 m	Dull yellowish orange (10YR6/3) moist, light grey (10YR8/1) dry; sandy clay loam; few subangular tuff; dry moderately weak. Abrupt, to-
B21	.35 to .60 m	Bright yellowish brown (10YR6/6) moist; medium clay; moderately moist very firm; few manganiferous nodules. Clear, to-
C	.60 to .90 m	Greyish yellow-brown (10YR6/2) moist; many fine distinct pale mottles; sandy clay; moderately moist moderately firm.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca Mg Na K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.8	.04	.003											
.10	5.8	.03	.002	39 30 18 13	9	1.9 1.2 .08 .46	.080	.25.	016	1.36	21	6	.69	
.25	5.9	.01	.001							1.12				
.35	5.8	.01	.001	35 28 22 13	7	1.4 1.2 .07 .10	.013	0.24	.009	1.31	18	6	.86	
.60	5.8	.01	.001	26 16 15 43	18	3.2 4.9 .50 .15	.008	0.40	.010	3.15	25	15	.68	
.90	6.2	.03	.002	60 17 8 12	14	45 .41 .2. 081	.029	0.45	.003	2.25	8	82	.3	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.2	.15	7	12	0.3	186	25	0.4	1.0
.10	1.9	.10	5	8	0.5	152	18	0.2	1.0
.25	0.8	.05	3	4	0.2				

SOIL TYPE: Silent Grove
SITE NO: MCL S56
A.M.G. REFERENCE: 686 700 mE 7 676 700 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.1
SOIL TAXONOMY UNIT: Udorthentic Chromustert
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Periodic cracking; recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .15 m	Black (10YR2/1) moist; brownish black (10YR3/1) dry; medium clay; strong (2mm granular; dry moderately weak. Clear, to-
B21	.15 to .75 m	Black (10YR1.7/1) moist; heavy clay; few subangular unspecified coarse fragments; moderately moist very firm. Gradual, to-
B22	.75 to 1.20 m	Brownish grey (10YR5/1) moist; few fine distinct yellow mottles; medium heavy clay; few subangular unspecified coarse fragments; moist; many carbonate nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca Mg Na K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	5.4	.04	.004											
.10	5.3	.03	.004	5 12 20 64	53	17 7 .37 .53	.040	0.17	0.24	7.28	41	24	.15	
.20	5.5	.02	.002							7.42				
.30	5.6	.02	.001	5 15 20 60	53	20 7.9 .55 .37	.038	0.17	.024	7.51	46	27	.47	
.60	5.9	.03	.003	6 12 19 61	48	27 8.2 1.1 .23	.021	0.14	.017	7.11	49	27	.48	
.90	8.1	.12	.004	4 7 13 74	66	48 15 1.9 .13	.025	0.23	.011	9.82	55	30	.62	
1.20	8.2	.11	.003	14 9 12 63	56	40 14 2.0 .15	.034	0.22	.030	8.13	46	27	.68	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Acid	Phosphorus Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	2.2	.14	20	18	0.5	107	128	3.0	0.7
.10	2.1	.14	16	15	0.6	104	120	2.9	1.1
.20	2.2	.15	47	44	0.5				

APPENDIX V (continued)

SOIL TYPE: Murray
SITE NO: MCL S57
A.M.G. REFERENCE: 688 700 mE 7 681 900 mN ZONE 55

GREAT SOIL GROUP: Alluvial soil
PRINCIPAL PROFILE FORM: Uc1.22
SOIL TAXONOMY UNIT: Typic Ustorthent
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Flood-plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .45 m	Brown (7.5YR4/3) moist; greyish yellow-brown (10YR6/2) dry; loamy sand; moderately moist loose. Abrupt; to-
2A1b	.45 to .65 m	Greyish brown (7.5YR4/2) moist; clay loam;fine sandy; moderately moist moderately weak. Gradual; to-
2B2b	.65 to 1.20 m	Brown (7.5YR4/3) moist; light clay; moderately moist moderately weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	7.0	.02	.002														
.10	5.6	.02	.002	65 27 4 2		6	2.9	1.5	.05 .13	.027	1.69	.007	0.85	7	3	1.5	
.20	5.3	.01	.001										0.86				
.30	5.4	.01	.001	57 34 4 6		6	3.5	1.4	.05 .13	.027	1.77	.008	0.91	8	4	.38	
.60	4.7	.01	.001	23 43 18 15		15	8.9	1.7	.12 .12	.040	1.79	.013	2.31	20	9	.72	
.90	6.1	.01	.001	3 48 22 26		17	12	2.1	.18 .11	.036	1.37	.014	2.74	23	11	.62	
1.20	6.2	.01	.001	4 45 22 29		17	14	2.8	.20 .11	.031	1.26	.011	3.36	25	13	.74	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	0.4	.03	59	27	0.3	48	24	0.4	0.8
.10	0.3	.03	90	36	0.2	69	21	0.4	0.9
.20	0.4	.02	53	35	0.2				

SOIL TYPE: Kungurri
SITE NO: MCL S58
A.M.G. REFERENCE: 688 300 mE 7 665 700 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Gn3.71
SOIL TAXONOMY UNIT: Ustochrept
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Andesite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .25 m	Brown (7.5YR4/3) moist; clay loam; dry moderately firm. Gradual; to-
B21	.25 to .50 m	Dull brown (7.5YR5/4) moist; common fine distinct red mottles; few fine faint grey mottles; light medium clay; moderately moist moderately firm; very few manganiferous nodules. Gradual; to-
B22	.50 to 1.00 m	Light grey (10YR7/1) moist; many fine prominent red mottles; few fine distinct yellow mottles; medium heavy clay; moderately moist moderately firm; very few manganiferous nodules. Diffuse; to-
BC	1.00 to 1.20 m	Light grey (10YR7/1) moist; many coarse prominent red mottles; many coarse prominent yellow mottles; light clay; moderately moist moderately weak.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS FS S C % @ 105C	CEC	Exch. Cations Ca	Mg	Na	K m.eq/100g	Total Elements P	K %	S	Moistures ADM	1/3b	15b % @ 105C	Disp.Ratio R1	R2
Bulk .10	4.9	.07	.004														
.10	5.0	.04	.002	12 46 17 26		25	3.7	4.1	.23 .28	.026	0.21	.018	3.34		13	.76	
.20	5.1	.02	.001										3.24				
.35	5.6	.02	.001	5 28 9 58		40	3.5	5.7	.98 .33	.015	0.29	.013	5.80	44	27	.41	
.60	5.2	.01	.001	8 28 7 53		47	3	6	1.8 .43	.007	0.36	.006	7.02	44	27	.40	
.90	5.4	.01	.001	7 28 11 50		48	2.6	5.5	2.3 .42	.007	0.35	.004	6.61	43	25	.57	
1.20	5.4	.01	.001	15 28 14 42		41	3	5.5	2.7 .30	.012	0.49	.004	6.24	34	41	.48	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid	Bicarb. ppm	Rep. K m.eq%	DTPA-extr. Fe	Mn	Cu	Zn ppm
Bulk .10	1.7	.12	7	11	0.4	194	22	2.2	1.8
.10	1.6	.12	7	10	0.3	144	16	2.3	1.6
.20	1.5	.11	17	22	0.2				

APPENDIX V (continued)

SOIL TYPE: Mirani
SITE NO: MCL 559
A.M.G. REFERENCE: 692 000 mE 7 657 400 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy5.82
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP	0 to .10 m	Dark greyish yellow (2.5Y4/2) moist; light grey (2.5Y7/1) dry; sandy loam; dry moderately weak. Gradual; to-
A2cb	.10 to .40 m	Dark greyish yellow (2.5Y5/2) moist; light grey (2.5Y7/1) dry; sandy loam; dry moderately weak. Clear; to-
A3cb	.40 to .45 m	Dull yellow (2.5Y6/3) moist; light yellowish orange (10YR8/3) dry; few fine distinct yellow mottles; sandy clay loam; dry moderately weak; few manganiferous nodules. Clear; to-
B21	.45 to .65 m	Dull yellow (2.5Y6/3) moist; few fine distinct brown mottles; sandy clay; few angular unspecified coarse fragments; dry moderately firm; few manganiferous nodules. Gradual; to-
B22	.65 to 1.20 m	Bright yellowish brown (10YR6/6) moist; many fine distinct grey mottles; sandy clay; many angular unspecified coarse fragments; dry moderately firm; very few manganiferous nodules.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C					m.eq/100g				%			% @ 105C				
Bulk .10	5.2	.04	.004																	
.10	5.5	.07	.004	42	40	8	8	4	1.3	.59	.08	.33	.029	1.35	.012	0.56	12	3	.92	
.20	5.1	.03	.002													0.79				
.30	5.0	.02	.001	43	36	14	9	4	.52	.23	.05	.15	.025	1.48	.007	0.70	12	3	.73	
.60	5.3	.02	.001	43	29	10	17	5	2.4	.36	.07	.10	.014	1.55	.008	1.14	14	6	.82	
.90	5.9	.03	.002	39	22	9	30	9	4.4	2.4	.30	.13	.018	1.50	.008	2.14	19	11	.82	
1.20	6.3	.05	.003	31	30	10	27	11	5.1	3.9	.70	.12	.019	1.47	.009	2.04	22	12	.89	

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.9	.05	88	95	0.4	130	10	0.3	0.9
.10	0.9	.05	108	108	0.4	144	10	0.4	1.3
.20	0.9	.04	81	68	0.3				

SOIL TYPE: Wollingford
SITE NO: MCL 560
A.M.G. REFERENCE: 700 600 mE 7 658 300 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT: Typic Natrustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few cobbles

SUBSTRATE MATERIAL: Igneous rocks
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 03 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
AP&b	0 to .30 m	Greyish brown (7.5YR4/2) moist; greyish brown (7.5YR6/2) dry; few fine distinct brown mottles; clay loam; fine sandy; dry moderately firm; few manganiferous nodules. Abrupt; to-
B1&b	.30 to .50 m	Dull yellowish brown (10YR5/3) moist; yellowish brown (10YR5/6) moist; light medium clay; few subangular igneous rocks; moderately moist moderately firm; few manganiferous nodules. Clear; to-
B21	.50 to 1.05 m	Greyish yellow-brown (10YR5/2) moist; many fine distinct yellow mottles; medium heavy clay; moderately moist very firm; few manganiferous nodules. Clear; to-
(B3)	1.05 to 1.20 m	Dull yellow (2.5Y6/3) moist; common fine faint yellow mottles; medium clay; moderately moist moderately firm; few carbonate nodules; few manganiferous nodules.

Depth	1:5 Soil/Water pH	EC	Cl	Particle Size CS	FS	S	C	CEC	Exch. Cations Ca	Mg	Na	K	Total Elements P	K	S	Moistures ADM	1/3b	15b	Disp.Ratio R1	R2
metres		mS/cm	%	% @ 105C					m.eq/100g				%			% @ 105C				
Bulk .10	5.5	.02	.002																	
.10	5.3	.02	.002	18	44	30	9	11	2.4	1.8	.09	.13	.017	0.28	.011	1.60	22	6	.83	
.20	5.4	.01	.001													1.34				
.30	5.7	.01	.001	19	40	28	15	11	2.8	1.8	.10	.08	.024	0.22	.013	1.74	21	7	.80	
.60	6.6	.02	.003	26	29	20	26	18	5.1	5.0	.70	.08	.070	0.16	.010	3.19	24	13	.88	
.90	7.1	.05	.005	13	31	19	37	23	9.2	9.1	2	.08	.009	0.12	.007	3.74	31	17	1.0	
1.20	8.8	.18	.008	3	37	21	38	36	16	16	5.3	.08	.009	0.13	.010	5.68	34	19	1.0	

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.8	.05	10	11	0.2	89	103	1.4	0.6
.10	0.8	.05	10	9	0.2	84	97	1.4	0.7
.20	0.6	.04	7	7	0.1				

APPENDIX V (continued)

SOIL TYPE: Sandiford
SITE NO: MCL S61
A.M.G. REFERENCE: 719 400 mE 7 648 500 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy3.32
SOIL TAXONOMY UNIT: Typic Haplustalf
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: No course fragments

SUBSTRATE MATERIAL: Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 00 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES

ANNUAL RAINFALL:

PROFILE MORPHOLOGY:

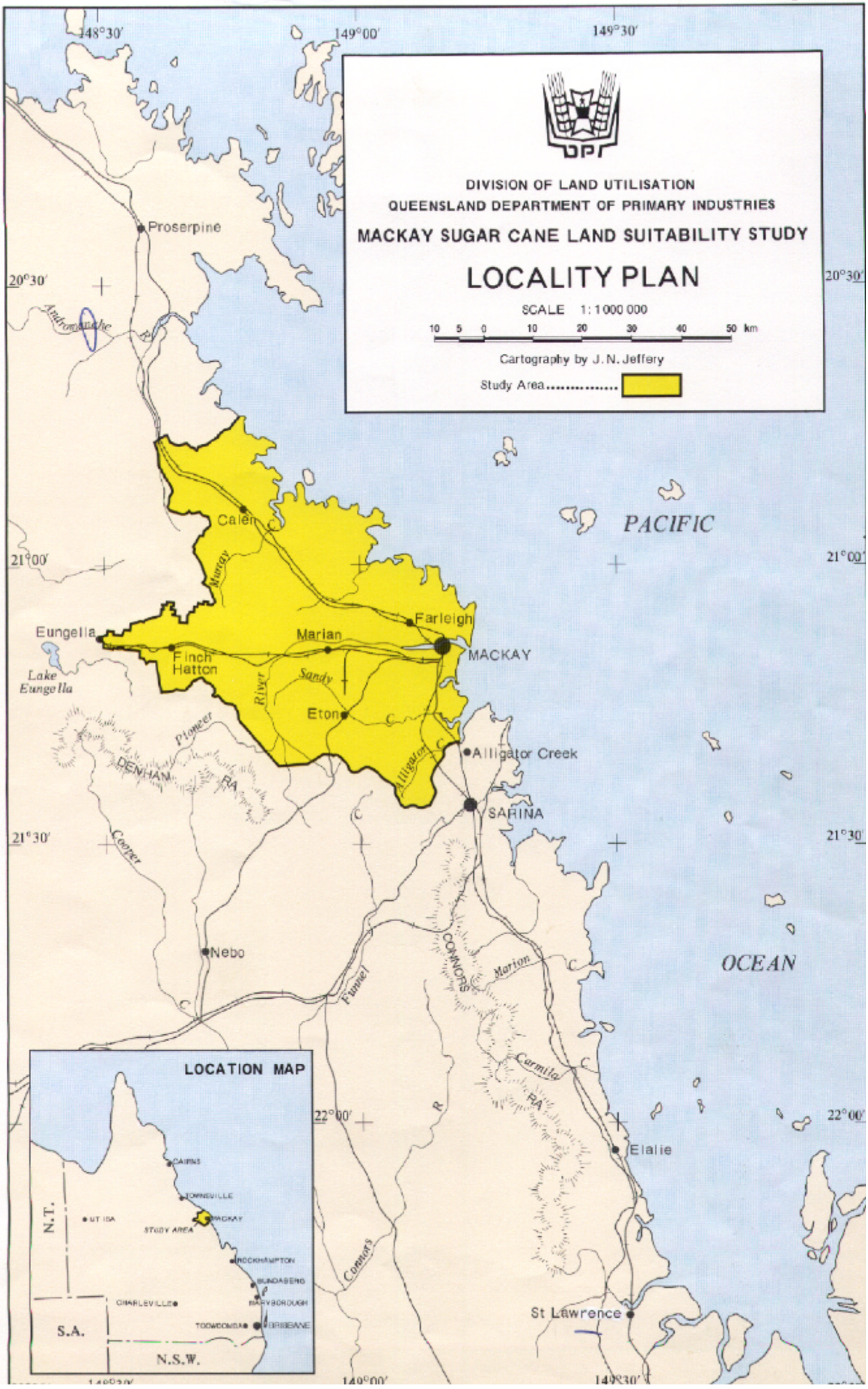
CONDITION OF SURFACE SOIL WHEN DRY: Recently cultivated

HORIZON	DEPTH	DESCRIPTION
APcb	0 to .30 m	Greyish yellow-brown (10YR4/2) moist; greyish yellow-brown (10YR6/2) dry; sandy clay loam; dry moderately firm. Abrupt; to-
B21	.30 to .70 m	Dull yellowish brown (10YR5/4) moist; few fine distinct yellow mottles; few fine distinct brown mottles; medium clay; moderately moist moderately firm; few manganiferous nodules. Gradual; to-
B22	.70 to 1.00 m	Bright yellowish brown (10YR6/8) moist; common fine prominent grey mottles; medium clay; few angular unspecified coarse fragments; moderately moist moderately firm; few manganiferous nodules; few manganiferous soft segregations. Gradual; to-
B23	1.00 to 1.15 m	Dull yellow (2.5Y6/4) moist; many medium prominent grey mottles; medium clay; few angular unspecified coarse fragments; moderately moist moderately firm; few manganiferous nodules; few manganiferous soft segregations. Clear; to-
D	1.15 to 1.20 m	Bright yellowish brown (10YR6/6) moist; common fine prominent grey mottles; light medium clay; many angular unspecified coarse fragments; moderately moist moderately weak; few manganiferous nodules; few manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.6	.04	.004																	
.10	5.3	.03	.004	22	50	15	13	7	1	.72	.10	.18	.029	1.39	.011	0.95	13	5	.85	
.20	5.1	.02	.002													1.04				
.30	5.1	.02	.001	18	53	17	13	7	.79	.46	.05	.13	.026	1.37	.010	1.07	14	5	.83	
.60	5.8	.04	.003	8	25	9	55	17	6.1	3.7	.65	.17	.022	1.02	.017	3.73	31	20	.45	
.90	6.3	.03	.003	17	38	10	34	13	4.5	4.3	.92	.11	.016	1.34	.009	2.77	25	14	.72	
1.25	7.0	.04	.003	8	25	10	55	12	5.7	5.5	1.5	.03	.017	1.39	.005	2.46	22	11	.52	

Depth	Org.C (W&B)	Tot.N	Extr. Acid	Phosphorus Bicarb.	Rep. K	DTPA-extr. Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.8	.04	45	33	0.3	128	30	0.5	0.5
.10	0.8	.04	35	31	0.2	145	35	0.6	0.6
.20	0.8	.04	63	107	0.2				

Figure 1.


DIVISION OF LAND UTILISATION
QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
MACKAY SUGAR CANE LAND SUITABILITY STUDY
LOCALITY PLAN
SCALE 1:1 000 000
10 5 0 10 20 30 40 50 km
Cartography by J.N. Jeffery
Study Area
148°30'
149°00'
149°30'
20°30'
21°00'
21°30'
22°00'
Proserpine
Andromache R.
Calen
Murray R.
Eungella
Lake Eungella
Finch Hatton
Marian
Farleigh
MACKAY
Sandy River
Eton
Alligator Creek
SARINA
Pioneer
DENHAM
RA
Cooper
Nebo
Funnel
CONNORS
Marion
Carmila
RA
Elalie
St Lawrence
Coastal
PACIFIC
OCEAN
LOCATION MAP
CAIRNS
TOWNSVILLE
MT ISA
MACKAY
STUDY AREA
ROCKHAMPTON
BUNDABERG
CHARLEVILLE
MARYBOROUGH
TOOWOOMBA
BRISBANE
N.T.
S.A.
N.S.W.